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The mealybug genus *Planococcus* (Homoptera: Pseudococcidae)

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CONTENTS

Synopsis. Descriptions and illustrations are provided for the 35 species considered here to belong in *Planococcus*, and a key given for their separation. Nine species are newly described and eight new synonymies are proposed. *Dactylopius calceolariae* var. *minor* Maskell from Mauritius, previously regarded as a synonym of Planococcus citri (Risso), is resurrected as *Planococcus minor*, and *P. pacificus* Cox synonymized with it. Five species, previously in *Planococcus*, are transferred to *Planococcoides*, and one species to *Crisicoccus*, as new combinations. Three species of *Crisicoccus*, *C. azaleae* (Tinsley), *C. matsumotoi* (Shiraiwa) and *C. matesovae* Danzig, are illustrated as they might be confused with similar species of *Planococcus*.

INTRODUCTION

Scale insects are amongst the most important pests of agricultural crops, debilitating the plant by loss of sap, contaminating the plant and its fruit with honeydew on which sooty mould frequently grows, transmitting plant viruses, and sometimes injecting toxins that stunt plant growth. Having lifecycles in a warm climate of as little as one month, mealybugs can rapidly attain very high numbers on their hostplant. Fortunately they are usually attacked by a wide range of natural enemies, in particular, encyrtid parasitic wasps and ladybird beetles. Most serious outbreaks of mealybugs occur when they are transported to new countries where their natural enemies do not occur, but in these cases biological control programmes have generally been very effective. Delays in attaining this control, however, have sometimes been caused by initial uncertainty as to the identity, and hence origin, of the mealybug species concerned, as described under the remarks for *Planococcus kenyae* (Le Pelley) below.

The genus *Planococcus* contains a number of well-known mealybug pests including *P. citri* (Risso) on citrus, cocoa and a wide variety of

plants in greenhouses, *P. ficus* (Signoret) on grapevines, figs and pomegranates, *P. kenyae* (Le Pelley) on coffee, and *P. lilacinus* (Cockerell) and *P. minor* (Maskell) on cocoa. *P. vovae* (Nasonov) occurs on *Cupressus* grown as shelter belts in the Mediterranean Basin and might be manipulated as a beneficial insect to encourage the presence of mealybug predators in the vicinity of crops. A number of other species occur on crop plants but are not at present regarded as pests, although this could change should they be introduced to other parts of the world where their natural enemies do not occur. Several of the species revised below are known largely from material intercepted on produce entering the U.K. or U.S.A. These species have considerable potential as future pests but, as their presumed geographical origins are listed here, they would be suitable candidates for biological control.

Planococcus citri is a vector of swollen shoot virus of cacao. However, it is likely that many of the virus-transmission experiments carried out on '*citri*' actually involved *minor*, as these two species were not distinguished until recently.

Some species of *Planococcus* show hostplant specificity at the plant family or genus level. Species of the *dendrobii*-group are apparently specific to Orchidaceae, the *vovae*-group to Cupressaceae, and *P. dubius* Cox to *Dracophyllum* (Epacridaceae). Others, despite having a wide host range, show distinct preferences. For example, *P. citri*, generally regarded as being polyphagous (which it is in greenhouses), is very rarely found out-of-doors on grapevines, while *P. ficus*, common on grapevines, is never found on citrus.

The identification of *Planococcus* species is hindered by the morphological variation that occurs as a result of the conditions under which the individuals develop. Cox (1983) showed *P. citricus* Ezzat & McConnell (1956) to be a high temperature form of *P. citri*. Structural characteristics may vary simply with environmental conditions, or there may be an 'optimum' effect with, for instance, specimens reared at high and low temperatures having few oral collar tubular ducts and specimens reared at medium temperatures having more. The result is that the characteristics distinguishing species may be different for different-sized individuals.

In the absence of live material it has been necessary to resort to multivariate analysis in an attempt to resolve some of the complexes discussed in the present paper.

Study of the current situation has been further confused by the shifting of populations by man - populations that may have been on the verge of speciation have been brought back together again. Thus, although *Planococcus* probably has an Old World origin, six species are now known to occur in the Neotropical Region: *P. citri, P. ficus, P. halli* Ezzat & McConnell, *P. lilacinus, P. minor* and *P. vovae*. All of these species were probably introduced into the Neotropical Region by man.

So much work has been done on this group that the time has come to bring together the available knowledge, and to attempt to resolve some of the remaining species complexes. This study has revealed that the the genus is even more complex than was previously appreciated, and it is apparent that a great deal more experimental work will be necessary to completely elucidate some of the complexes.

Distinction of *Planococcus* from similar genera

Planococcus is not satisfactorily distinguished from other genera. The evolution of mealybugs has apparently involved the loss rather than gain of characters in the adult females, making phylogenetic analysis based on females intractable. Studies of males would probably lead to a better understanding of relationships, but associated males are not available for most species.

One of the consequences of this arbitrary distinction of mealybug genera is that some species of *Planococcus* may be more closely related (by descent) to species currently placed in other genera than they are to other species of *Planococcus*. This is particularly the case with *Crisicoccus* which is distinguished from *Planococcus* only by the loss of some of the cerarii - an occurrence that is likely to have happened more than once. In this paper, such members of *Crisicoccus* that are very similar to species of *Planococcus* have been illustrated.

Cox & Ben-Dov (1986) synonymized *Allococcus* with *Planococcus* and transferred a group of African species previously in *Allococcus* to a new genus, *Delottococcus*. Cox & Freeston (1985) gave characters for distinguishing between the closely related *Planococcus* and *Planococcoides* and transferred *Pseudococcus celtis* Strickland and *Planococcus lamobokensis* Matile-Ferrero to the latter genus. In addition, as mentioned above, *Crisicoccus* is very similar to *Planococcus*. These four genera may be distinguished by the following key.

1 Cerarii numbering less than 18 pairs
CRISICOCCUS Ferris

– Cerarii numbering 18 pairs, although some thoracic pairs may be indistinct 2

2 Circulus absent, translucent pores absent from hind coxae ..... ***DELOTTOCOCCUS*** Cox & Ben-Dov

– Circulus usually present, translucent pores usually present on hind coxae 3

3 All abdominal cerarii anterior to anal lobe pair with only 2 conical setae and without slender auxiliary setae, anal lobe cerarii each with only 2 conical setae ***PLANOCOCCUS*** Ferris

– Some abominal cerarii anterior to anal lobe pair with either more than 2 conical setae or with slender auxiliary setae, anal lobe cerarii each with 2 or more cerarii .. ***PLANOCOCCOIDES*** Ezzat & McConnell

New combinations

The following five species hitherto placed in *Planococcus* are here transferred to *Planococcoides:*

Planococcoides crassus (De Lotto, 1961: 219) (*Planococcus*) **comb. n.**

Planococcoides formosus (De Lotto, 1961: 221) (*Planococcus*) **comb. n.**

Planococcides rotundatus (De Lotto, 1954: 110) (*Planococcus*) **comb. n.**

These three African species are very similar to each other and to *P. celtis* (Strickland) (transferred to *Planococcides* by Cox & Freeston, 1985) in having a rotund body, multilocular disc pores confined to mid-regions of the abdomen, flagellate dorsal setae and large simple pores. They differ from the type species of *Planococcoides, P. njalensis,* by lacking dorsal ducts. Another African species, *P. lamabokensis* (Balachowsky & Ferrero), (also transferred to *Planococcoides* by Cox & Freeston, 1985), does have dorsal tubular ducts and may be a synonym of *P. njalensis.*

Planococcoides anaboranae (Mamet, 1959: 403) (*Planococcus*) **comb. n.**

This species is similar to *Planococcoides lindingeri* (Bodenheimer) from the Mediterranean Basin, which was transferred to *Planococcoides* by Cox & Ben-Dov (1986).

Planococcoides mumensis (Tang, 1977: 34) (*Planococcus*) **comb. n.**

This species was described from the leaves of *Prunus mume* in the Zhejiang Province of China. Although it was not possible to obtain specimens of *P. mumensis* for examination, Professor Tang kindly provided an English translation of his original description and a further illustration. From these it is apparent that this species has auxiliary setae in all of the cerarii, the anal lobe cerarii each have 2 or 3 conical setae, multilocular disc pores are confined to the median areas of the posterior abdominal segments, and tubular ducts are confined to the posterior abdominal segments of the venter. Consequently, *Planococcus mumensis* is here transferred to *Planococcoides.*

Also currently included in *Planococcoides* are *P. ireneus* De Lotto from the Afrotropical Region, *Planococcoides robustus* Ezzat & McConnell from India, and *P. pauliani* Mamet from Madagascar.

Crisicoccus matesovae (Danzig, 1986: 21) (*Planococcus*) **comb. n.**

Checklist of species here included in *Planococcus*

This list includes new combinations, new synonymies, distributions and hostplant preferences where known. The original generic names, if these are not *Planococcus,* are given in parenthesis.

aemulor De Lotto, 1964.
Afrotropical Region, on *Combretum spendens* and *Asparagus* sp.

aphelus De Lotto, 1967.
Afrotropical Region, on *Phylica* sp.

boafoensis (Strickland, 1947) (*Tylococcus*).
Afrotropical Region, on *Musanga* spp.

citri (Risso, 1813) (*Dorthesia*).
Phenacoccus spiriferus Hempel, 1900. **Syn. n.**
Planococcoides cubanensis Ezzat & McConnell, 1956. **Syn. n.**
Planococcus cucurbitae Ezzat & McConnell, 1956. **Syn. n.**
Cosmopolitan, on many hostplants, especially citrus, coffee and cocoa.

dendrobii Ezzat & McConnell, 1956.
Oriental Region, on orchids.

dioscoreae Williams, 1960.
Austro-oriental Region, usually on yams.

dorsospinosus Ezzat McConnell, 1956.
Planococcus myrsinephilus Borchsenius, 1962. **Syn. n.**
Planococcus sinensis Borchsenius, 1962. **Syn. n.**
Palaearctic, Oriental and Austro-oriental Regions, on a variety of trees.

dubius Cox, 1987.
New Zealand, on *Dracophyllum.*

epulus De Lotto, 1964.
Afrotropical Region, on *Pterolobium lacerans.*

ficus (Signoret, 1875) (*Dactylopius*).
Dactylopius subterraneus Hempel, 1901. **Syn. n.**
Palaearctic, Afrotropical, Oriental and Neotropical Regions, on a variety of hostplants, especially grapevines, figs and pomegranates.

flagellatus De Lotto, 1961.
Afrotropical Region, on a variety of hosts.

furcisetosus Mamet, 1959.
Malagasian Region, on *Diospypros* sp.

halli Ezzat & McConnell, 1956.
Neotropical and Afrotropical Regions, on a variety of hostplants, especially yams.

hospitus De Lotto, 1961.
Afrotropical Region, on orchids.

hosyni Ezzat & McConnell, 1956.
Afrotropical Region on orchids.

japonicus sp. n.
Japan (frequently intercepted in the U.S.A.), on a variety of trees, including loquat.

kenyae (Le Pelley, 1935) (*Pseudococcus*).
Planococcus subukiaensis De Lotto, 1954. **Syn. n.**
Afrotropical Region, on a variety of hostplants, especially coffee and cocoa.

kraunhiae (Kuwana, 1902) (*Dactylopius*).
Planococcus siakwanensis Borchsenius, 1962. **Syn. n.**
Palaearctic, Oriental and Nearctic Regions, on a variety of trees, including citrus.

lilacinus (Cockerell, 1905) (*Pseudococcus*).
Pseudococcus deceptor Betrem, 1937. **Syn. n.**
Malagasian, Oriental, Austro-oriental and Neotropical Regions, on a variety of hostplants including citrus, guava, cocao, coffee, custard apple and mango.

litchi sp. n.
Palaearctic, Oriental and Austro-oriental Regions (all interceptions in the U.K. or U.S.A.), on lychee and loquat.

mali Ezzat & McConnell, 1956.
New Zealand and Australia, on a variety of woody hostplants, especially apple and blackcurrant.

martini sp. n.
Austro-oriental Region, on Araceae.

minor (Maskell, 1897) (*Pseudococcus*). **Nom. rev., stat. n., comb. n.**
Planococcus pacificus Cox, 1981. **Syn. n.**
Oriental, Austro-oriental, Australian, Polynesian, Neotropical and Malagasian Regions, on a wide variety of hostplants including cocoa and coffee.

morrisoni (Ezzat & McConnell, 1956) (*Allococcus*).
Oriental and Austro-oriental Regions (all intercepted in the U.S.A.), on mangosteen, lychee, *Lansium domesticum* and *Melicoccus bijugatus*.

nigritulus De Lotto, 1961.
Afrotropical Region, on *Phoenix dactylifera* and *Ficus* sp.

orchidi sp. n.
Afrotropical Region, on orchids.

philippinensis Ezzat & McConnell, 1956.
Austro-oriental Region, on orchids.

principe sp. n.
Afrotropical Region, on cocoa.

psidii sp. n.
Austro-oriental Region, on *Psidium guajava*.

subterraneus De Lotto, 1964.
Afrotropical Region, on *Ficus* sp.

sulawesi sp. n.
Austro-oriental Region, on Urticaceae.

taigae Danzig, 1986.
Palaearctic Region, on Cupressaceae.

tanzaniensis sp. n.
Afrotropical Region, on *Hevea braziliensis*.

vovae (Nasonov, 1908) (*Pseudococcus*).
Palaearctic and Neotropical Regions, on Cupressaceae.

zairensis sp. n.
Afrotropical Region.

Species-groups in *Planococcus*

Several, apparently monophyletic, species-groups can be distinguished amongst this assemblage of species. The *citri*-group contains those species which have marginal multilocular disc pores on the abdominal venter, tubular ducts on the venter of all abdominal segments and on the head and thorax, and flagellate dorsal setae. As it contains the type-species of the genus, this group constitutes *Planococcus* sensu stricto, and includes *P. aphelus, P. citri, P. epulus, P. ficus, P. flagellatus, P. halli, P. minor, P. nigritulus, P. subterraneus, P. tanzaniensis* and probably *P. aemulor* and *P. kenyae*. *P. aemulor* lacks tubular ducts on the head and thorax, while *P. kenyae* lacks marginal multilocular disc pores and, in small specimens, it sometimes also lacks tubular ducts on the head and thorax. All of these species, except *P. minor*, occur in the Mediterranean Basin or the Afrotropical Region, although *P. citri, P. ficus* and *P. halli* have been transported to other parts of the world. The geographical origin of *P. minor* is not clear - its current distribution includes the South Pacific, the Oriental, Austro-oriental, Australian, Malagasian and Neotropical Regions.

Another group, the *dendrobii*-group, contains eight species of which five have been found only on Orchidaceae. All eight species are rotund, have stout legs and have the multilocular disc pores and tubular ducts confined to the posterior abdominal segments. All of the orchid-feeding species have knobbed dorsal setae. Two of these species, *P. dendrobii* and *P. philippinensis*, are from the Oriental Region, and 3 species, *P. hospitus, P. hosyni* and *P. orchidi*, are from the Afrotropical Region. *P. zairensis* from an unknown hostplant in Zaire and *P. martini* from Araceae in Indonesia are similar to the above

species, but lack knobbed dorsal setae. *P. furcisetosus* from ebony in Madagascar differs from the orchid-feeding species only by having furcate dorsal setae. *P. principe* may belong in this group, but this species has a few marginal multilocular disc pores. The body shape and distributions of the multilocular disc pores and tubular ducts of the *dendrobii*-group are similar to those found in most species of *Planococoides* and it may not be a genuine component of *Planococcus*.

A third group, the *dorsospinosus*-group, comprises those species which lack marginal multilocular disc pores and have conical dorsal setae with associated aggregations of trilocular pores. These species are from the Oriental and Australoriental Regions and Japan. The *dorsospinosus*-group comprises *P. dioscoreae, P. dorsospinosus* and *P. litchi. P. sulawesi* clearly also belongs to this group, but in this species the enlarged dorsal setae are very long and flagellate. *P. krauhniae* from Japan and *P. psidii* from West Malaysia may also belong to this group, but both have marginal multilocular disc pores and the trilocular pores are not as obviously associated with the enlarged dorsal setae as in the above-mentioned species.

The two species of the *vovae*-group, *P. taigae* and *P. vovae,* are both confined to Cupressaceae. Each has a distinct geographical range, *P. vovae* occurring in central and southern Europe, the Caucasus and montane Central Asia (also Brazil), and *P. taigae* in the north-eastern parts of the Palaearctic Region. These species are characterized by their flagellate cerarian setae, numerous dorsal tubular ducts, and by lacking marginal multilocular disc pores. Otherwise, they are similar to the *P. citri*-group. *Crisicoccus matesovae,* known only from Cupressaceae in Altai, U.S.S.R., is very similar to both of these species, but has fewer than 18 pairs of cerarii and has consequently been transferred from *Planococcus* to *Crisicoccus* (see above).

The remaining group that can be distinguished is the *mali*-group comprising *P. japonicus, P. mali,* and perhaps *P. morrisoni.* These species are characterized by having short, stout, almost conical, dorsal setae and a marginal group of tubular ducts adjacent to the anterior spiracles, while these ducts are absent, or in very low numbers, on the margins of the head and mesothorax. In addition, *P. japonicus* and *P. mali* both have more than 2 conical setae in most of the cephalic and thoracic cerarii. *P. japonicus* is known only from Japan, *P. mali* only from Australia and New Zealand (although its true origin may lie closer to Japan - see under remarks for this species), and *P. morrisoni* is from the Oriental Region. In *P. mali,* some of the pairs of cerarii may be indistinct or apparently absent, making it appear to be a member of *Crisicoccus,* although most specimens have a full complement of 18 pairs of cerarii. Both *P. japonicus* and *P. mali* are similar to species of *Crisicoccus,* such as *C. azaleae* (Tinsley) and *C. matsumotoi* (Shiraiwa), and may, in fact, be more closely related to these species than to the *P. citri*-group. *C. azaleae* and *C. matsumotoi* have been illustrated in this work to allow the easy distinction of these species.

A few remaining species have no obvious affinities with any of the above groups. *P. boafoensis,* from the Afrotropical Region, is remarkable in having the cerarii situated on protuberances, but otherwise has very reduced numbers of multilocular disc pores and tubular ducts and has short, stout, dorsal setae. It is perhaps closest to the *dendrobii*-group. The Oriental *P. lilacinus* is an enigma, having a rotund body, stout legs, reduced numbers of multilocular disc pores, but tubular ducts extending around the margins of the entire body. The dorsal setae are very long, and quite stout. The true origin of this species may be from outside the genera discussed here.

From the above it can be seen that the species of *Planococcus* revised in this work almost certainly do not comprise a monophyletic group. However, the prime purpose of this study is not to propose a generic system based on phylogenetic relationships, but to provide a means for the identification of a group of similar looking species, many of which are real or potential pests of economically important plants. To this end, illustrations have been provided of some similar (and perhaps related) species currently placed in other genera with which some of the species covered here might be confused.

Terminology

The major characters used are illustrated in Fig. 1. Cerarii are counted starting at the anterior end. Abdominal segments are counted in such a way that the circulus lies between segments III and IV, and the vulva lies between segments VII and VIII. Although the translucent pores on the hind legs usually occur on the hind surface, and hence would be hidden in the illustrations as presented, they have been illustrated here as if they are on the frontal surface of the legs. Numbers of pores and ducts, when given in the text, are totals of both sides of the body - mealybugs are frequently not symmetrical in the distribution of their characters.

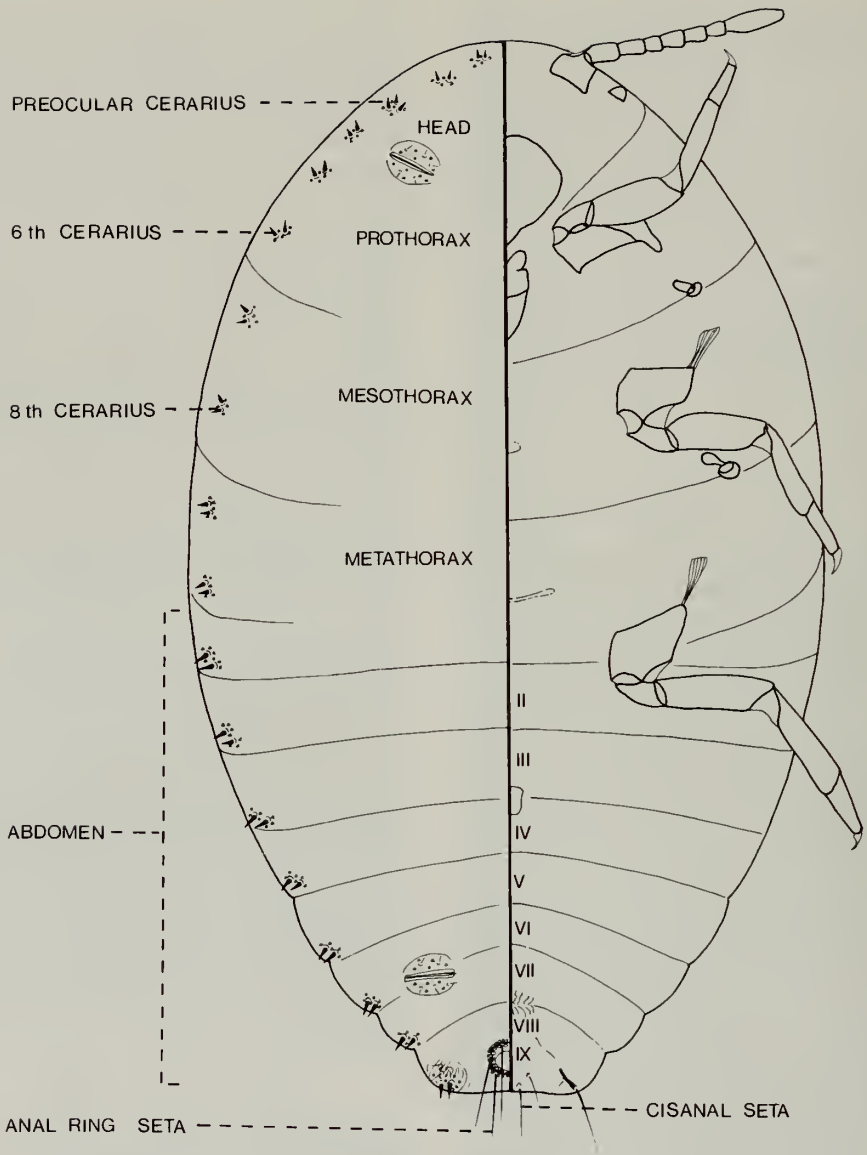

Fig. 1 Generalized diagram of *Planococcus* sp. showing numbering of body segments and cerarii.

Depositories

BMNH British Museum (Natural History), London, U.K.

IBSP Instituto Biologico de São Paulo, Brazil.

MNHN Muséum National d'Histoire Naturelle, Paris, France.

MZSP Museu de Zoologia, Universidade de São Paulo, Brazil.

NZAC New Zealand Arthropod Collection, Auckland, New Zealand.

SANC South African National Collection of Insects, Pretoria, South Africa.

UCD University of California, Davis, U.S.A.

USNM United States National Museum, Washington D.C., U.S.A.

VCCB Vernalna Collection, Universidade Federal do Parana, Curitiba, Brazil.

VCI Coccoidea Collection, Department of Entomology, The Volcani Center, Bet Dagan, Israel.

ZIL Zoological Institute, U.S.S.R. Academy of Sciences, Leningrad, U.S.S.R.

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SYSTEMATICS

PLANOCOCCUS Ferris

Planococcus Ferris, 1950: 164. Type-species: *Dactylopius citri* Risso, by original designation.
Allococcus Ezzat McConnell, 1956: 13. Type-species: *Pseudococcus inamabilis* Hambleton, by original designation. [Synonymy by Cox & Ben-Dov, 1986.]

ADULT FEMALE. Body shape oval to rotund. Cerarii numbering 18 pairs, thoracic cerarii indistinct in some specimens of a few species, but other specimens of that species having the full number; abdominal cerarii each with 2 conical setae and several long flagellate auxiliary setae, thoracic and remaining abdominal cerarii each with only 2 conical or flagellate setae and without auxiliary setae, cephalic cerarii each with 1-5 conical or flagellate setae. Circulus usually present, quadrate in most species, but small and round in some species. Legs well-developed in most species, but short and stout in some species; translucent pores usually present on hind coxae and tibiae only, sometimes present also on hind femora in *P. ficus*, absent from the hind tibiae in *P. dendrobii* and *P. philippinensis* and apparently completely absent from the hind legs in *P. aemulor* and *P. hospitus*; claw without denticle. Anal lobe bars always apparent. Anal ring of usual pseudococcid form, with 6 long setae.

Multilocular disc pores usually confined to venter, although present on dorsum in *P. epulus* and *P. dubius*; always present in at least single rows across posterior borders of mid-regions of posterior abdominal segments, variably present on head, thorax, anterior borders of abdominal segments and margins of abdominal segments. Trilocular pores usually evenly distributed, but aggregated around bases of enlarged dorsal setae in the *dorsospinosus*-group. Tubular ducts generally of the oral collar type, sparse to numerous on the venter, sometimes present on the dorsum where they may appear to have rims. Simple pores generally smaller than the trilocular pores, but larger in some species; often aggregated in groups on the dorsal mid-regions of the anterior abdominal segments. Setae long, fine and flagellate on median areas of venter; variable on dorsum, flagellate in the *citri*- and *vovae*-groups, stout, almost lanceolate, in the *mali*-group, conical in the *dorsospinosus*-group and knobbed in the dendrobii-group; setae on the marginal areas of the venter often similar to those on the dorsum.

Key to species of *Planococcus*

1 Multilocular disc pores present on dorsum 2
– Multilocular disc pores absent from dorsum ... 3
2 Most cephalic and thoracic cerarii each with three conical setae, dorsal setae stout, found in New Zealand only (Fig. 9) ..... ***dubius***
– Most cephalic and thoracic cerarii each with 2 conical setae, dorsal setae slender, found in Kenya only (Fig. 10) ..... ***epulus***
3 All cerarii situated on very pronounced sclerotized protuberances, tubular ducts and multilocular disc pores few in number and restricted to median areas of the posterior abdominal segments, dorsal setae short and stout, almost lanceolate, known only from the Afrotropical Region (Fig. 4) . ***boafoensis***
– Cerarii not situated on protuberances, although very young adults may sometimes give this appearance, other characters various 4
4 Anal lobe cerarii each situated on a large, prominent, sclerotized area, body oval to rotund, cisanal setae longer than anal ring setae, multilocular disc pores very few or absent on margins and on anterior edges of median areas of abdominal segments, dorsal tubular ducts absent, ventral tubular ducts present in marginal groups on all abdominal segments, often also present on head and thorax, found in the Afrotropical Region (Fig. 20) ..... ***kenyae***
– Anal lobe cerarii situated on small, not particularly prominent, sclerotized areas, other characters various 5
5 Oral collar tubular ducts absent from both median and marginal areas of head and thorax 6
– Oral collar tubular ducts usually present on median areas of thorax, if absent, then present on margins of head and thorax 14
6 Many dorsal setae furcate, found in Madagascar only (Fig. 13) ..... ***furcisetosus***
– Dorsal setae never furcate 7

7 Ventral simple pores as large as the multilocular disc pores, known only from Uganda (Fig. 15) ***hospitus***

– Ventral simple pores, if apparent, considerably smaller than the multilocular disc pores 8

8 No more than 1 tubular duct present on each side of each abdominal segment, known only from the Afrotropical Region 9

– Tubular ducts present in small groups on either side of abdominal segments VI and VII, known from the Afrotropical, Oriental and Austro-oriental Regions 10

9 Dorsal setae short and stout, tubular ducts and multilocular disc pores usually present singly on margins of some posterior abdominal segments (Fig. 40) ..... ***zairensis***

– Dorsal setae moderately long and fine, margins of abdominal segments never with tubular ducts or multilocular disc pores, known only from the Afrotropical Region (Fig. 16) ..... ***hosyni***

10 Margins of posterior abdominal segments each with a few multilocular disc pores, translucent pores absent from hind legs, dorsal setae not knobbed, known only from Kenya (Fig. 2) ..... ***aemulor***

– Margins of abdominal segments without multilocular disc pores, translucent pores present on hind coxae, often also on hind tibiae, dorsal setae sometimes knobbed 11

11 Dorsal setae not knobbed, antennae 7-segmented, known only from Indonesia (Fig. 26) .... ***martini***

– Dorsal setae distinctly knobbed, antennae 8-segmented 12

12 Simple pores on venter very conspicuous and about twice the size of the trilocular pores, translucent pores present on hind tibiae, known only from Liberia (Fig. 30) ..... ***orchidi***

– Simple pores inconspicuous and about half the size of the trilocular pores, translucent pores absent from hind tibiae, found in the Oriental and Austro-oriental Regions 13

13 Circulus present, cisanal setae shorter or about the same length as the anal ring setae, simple pores on mid-region of dorsum smaller than the trilocular pores (Fig. 6) ..... ***dendrobii***

– Circulus absent, cisanal setae longer than the anal ring setae, simple pores on mid-region of dorsum, particularly on the posterior segments, larger than the trilocular pores (Fig. 31) ..... ***philippinensis***

14 Tubular ducts with pronounced oral rims present on dorsum adjacent to several cerarii and scattered over median area of dorsum, dorsal setae short and stout, almost lanceolate, found in the Oriental and Austro-oriental Regions (Fig. 28) ..... ***morrisoni***

– If more than 2 oral rim tubular ducts present on dorsum, then dorsal setae long and slender ... 15

15 Several cephalic and thoracic cerarii usually each with more than 2 conical setae, some thoracic and anterior cerarii usually indistinct and with only 1 conical seta 16

– Cephalic and thoracic cerarii each with only two conical setae, except for preocular pair which sometimes have three conical setae in each cerarius, all cerarii distinct and with 2 conical setae 17

16 Number of ventral tubular ducts on margins of prothorax totalling 0–45, length of hind tibia + tarsus 305–410 μm, known only from Australia and New Zealand (Fig. 24) ..... ***mali***

– Number of ventral tubular ducts on margins of prothorax totalling 24–63, length of hind tibia + tarsus 235–315 μm, known only from Japan (Fig. 17) ***japonicus***

17 Multilocular disc pores present on margins of abdominal segments, even if only 1 or 2 per segment 18

– Multilocular disc pores completely absent from margins of abdominal segments 26

18 Many simple pores on both venter and dorsum almost as large as the multilocular disc pores, known only from Principe (Fig. 32) ..... ***principe***

– Simple pores on both venter and dorsum never more than twice the size of the trilocular pores 19

19 Dorsal setae with distinctly swollen bases, multilocular disc pores very sparse on margins of abdominal segments, oral collar tubular ducts on dorsum in groups of 2–5 ducts adjacent to some abdominal cerarii, found in Japan and U.S.A. (Fig. 21) ***kraunhiae***

– Dorsal setae without swollen bases, multilocular disc pores moderately numerous on margins of abdominal segments, tubular ducts, if present on dorsum, usually present singly adjacent to cerarii 20

20 Circulus absent, known only from South Africa (Fig. 3) ..... ***aphelus***

– Circulus present 21

21 Oral collar tubular ducts absent from abdominal segments IX, and often also from VIII, body broadly oval to rotund, ventral simple pores at least same size as the trilocular pores, dorsal setae stout, found only in the Afrotropical Region 22

– Oral collar tubular ducts present on venter of both abodominal segments VIII IX, body elongate-oval to broadly oval, simple pores smaller than the trilocular pores, dorsal setae slender, widely distributed 23

22 Oral collar tubular ducts present on ventral, median areas of thorax, tubular ducts usually present on venter of abdominal segment VIII, simple pores about the same size as the trilocular pores (Fig. 38) ***tanzaniensis***

– Oral collar tubular ducts absent from median areas of thorax, although present on margins of head and thorax, tubular ducts absent from both abdominal segments VIII IX, ventral simple pores about twice the size of the trilocular pores (Fig. 29) ***nigritulus***

23 Dorsal setae long and fleshy, longest setae on abdominal segment VI or VII up to 100 μm long, sometimes strongly bifurcate 24

– Dorsal setae either short (less than 30 μm long) or if longer, then slender, never fleshy or bifurcate 25

24 Several dorsal setae strongly bifurcate, oral collar tubular ducts absent from head, known only from South Africa (Fig. 34) ..... ***subterraneus***

– No more than 2 dorsal setae bifurcate, at least 4 oral collar tubular ducts present on head, found in the Afrotropical Region (Fig. 12) ..... ***flagellatus***

25 Head with 0–35 oral collar tubular ducts, longest seta on median area of abdominal segment VI or VII 17–33 μm long, cerarian setae on head and thorax always conical, dorsum rarely with more than 6 oral collar tubular ducts, median ventral area of abdominal segment VII with a single or double row of multilocular pores, translucent pores never present on hind femora 26

– Head with 0–4 oral collar tubular ducts, longest seta on median area of abdominal segment VI or VII 25–50 μm long, cerarian setae on head and thorax often long and slender, dorsum with 0–20 oral collar tubular ducts, median ventral area of abdominal segment VII usually with a single row of multilocular disc pores, translucent pores sometimes present on hind femora 27

26 Dorsal setae blunt-ended, translucent pores on hind legs noticeably large and distinct, known only from West Malaysia (Fig. 33) ..... ***psidii***

– Dorsal setae flagellate, translucent pores on hind legs typical of genus, worldwide (see Table 1) ***citri/minor***

27 Translucent pores often apparent on one or both hind femora; total number of multilocular disc pores behind the front coxae 0–17; rows of median multilocular disc pores usually present on abdominal segments IV-VII, sometimes also on III; 1 or 2 multilocular disc pores usually present on each margin of abdominal segments II and III; common on grapevines in the Mediterranean Basin, Pakistan, Argentina and South Africa (Fig. 11) ..... ***ficus***

– Translucent pores absent from hind femora; multilocular disc pores behind front coxae totalling 0–5; rows of multilocular disc pores present on abdominal segments III-VII, often also on II; multilocular disc pores seldom present on margins of abdominal segment II, sometimes present on margins of III; common on *Dioscorea* spp. in the West Indies and the Afrotropical Region (Fig. 14) ..... ***halli***

Table 1 Separation of *P. citri* and *P. minor*.

Character	Value	Score
(All numbers are the totals from both sides of the body)		
A. Number of ventral tubular ducts on head	0–3	0
	4–13	10
	14–35	40
B. Number of ventral tubular ducts adjacent to 8th pair (numbering from the anterior) of cerarii	0–2	0
	3–7	10
	8–30	40
C. Tubular ducts present between 2nd and 3rd cerarii on head on at least one side of the body	yes	10
	no	0
D. Number of multilocular disc pores behind front coxae	0–6	5
	7–12	0
E. Ratio of length of hind tibia + tarsus to length of trochanter + femur	1.00–1.07	0
	1.08–1.17	5
	1.18–1.30	10
F. Width of row of multilocular disc pores on posterior margin of abdominal segment VI	single row	15
	intermediate	5
	double row	0

Scores: 0–35 = *minor* (Fig. 27) (p. 000)
35–120 = *citri* (Fig. 5) (p. 000)

28 Cephalic cerarian setae flagellate, dorsal tubular ducts in rows across posterior abdominal segments, on Cupressacae 29

– Cephalic cerarian setae usually conical, dorsal tubular ducts, if present, occurring singly adjacent to cerarii, not found on Cupressaceae 30

29 Dorsal tubular ducts in rows of up to 24 ducts across posterior abdominal segments, total of more than 200 ducts on dorsum, found in the eastern Palaearctic Region (Fig. 36) ..... ***taigae***

– Dorsal tubular ducts in rows of no more than 18 ducts across posterior abdominal segments, total of 13–110 ducts on dorsum, widespread in the western Palaearctic Region and also in Brazil (Fig. 39) ***vovae***

30 All dorsal setae noticeably long and flagellate, longest seta on abdominal segment VI or VII 50–140 μm long, with or without trilocular pores associated with their bases 31

– Most dorsal setae conical, some almost as large as cerarian setae, and with one or more trilocular pores associated with their bases 32

31 Legs noticeably short and stout, ratio of hind tibia + tarsus to hind trochanter + femur 0.77–0.97; dorsal setae without trilocular pores associated with their bases; found in the Oriental, Austro-oriental, Malagasian and Neotropical Regions (Fig. 22) ***lilacinus***

– Legs elongate, ratio of hind tibia + tarsus to hind trochanter + femur 1.06–1.07; larger dorsal setae with one or more trilocular pores associated with their bases; known from Indonesia only (Fig. 35) ***sulawesi***

32 Several dorsal setae associated in pairs (Fig. 23) ***litchi***

– Dorsal setae not in pairs 33

33 Ventral tubular ducts adjacent to eyes totalling 6–22, found in Papua New Guinea and the Solomon Islands, usually on *Dioscorea* sp. (Fig. 7) ***dioscoreae***

– Ventral tubular ducts adjacent to eyes totalling no more than 7, known only from Japan and the Oriental Region on a variety of hosts (Fig. 8) ***dorsospinosus***

Descriptions of species

Planococcus aemulor De Lotto

(Fig. 2)

Planococcus aemulor De Lotto, 1964: 372. Holotype ♀, KENYA: on *Combretrum splendens* (BMNH) [examined].

ADULT FEMALE. Mounted specimens broadly oval, length 1.6–1.9 mm, width 1.1–1.4 mm. Antennae 7- or 8-segmented, if 7-segmented, then pseudoarticulation apparent on segment IV. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 (rarely 3 on head) slender conical setae. Legs elongate; hind trochanter + femur 255–280 μm long, hind tibia + tarsus 265–285 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.00–1.07; translucent pores not apparent on hind legs. Inner edges of ostioles moderately sclerotized. Circulus large and probably quadrate, although generally distorted in mounted specimens, width 170–200 μm. Cisanal setae shorter than anal ring setae. Anal lobe area apparently only slightly sclerotized.

Venter. Multilocular disc pores moderately numerous around vulva, present in single rows across posterior edges of median areas of abdominal segments III-VII or IV-VII, a few pores present on anterior edge of median area of segment VII and on margins of at least some posterior segments. Trilocular pores numerous and evenly distributed. Oral collar tubular ducts, apparently of 1 size and confined to the abdomen, present sparsely in rows across median areas of abdominal segments III-VII and in marginal groups on segments IV-VIII, but usually absent from segments VIII or IX. Simple pores slightly larger than the trilocular pores, sparsely scattered over venter.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores of 2 sizes, larger pores as for venter, smaller pores about a third of the size of the trilocular pores, sparsely scattered over dorsum. Setae stout, blunt-ended and moderately short, longest seta on abdominal segments VI or VII 25–35 μm long.

MATERIAL EXAMINED

Holotype ♀, **Kenya**: Ruiru, on *Combretum splendens*, 20.viii.1957 (*R. H. Le Pelley*) (BMNH). 6 paratype ♀, same data as holotype (BMNH).

DISTRIBUTION. Afrotropical Region: Kenya.

HOSTPLANTS. Combretaceae: *Combretum splendens*. Also recorded from *Asparagus* sp. (Liliaceae) (De Lotto, 1964).

REMARKS. *P. aemulor* resembles *P. nigritulus* in lacking tubular ducts on the median areas of the thoracic venter and in usually lacking ducts on abdominal segments VIII andIX. The two species may be distinguished by the presence of marginal ventral tubular ducts on the head and thorax and translucent pores on the hind coxae and tibiae in *P. nigritulus*, both of which characters are lacking

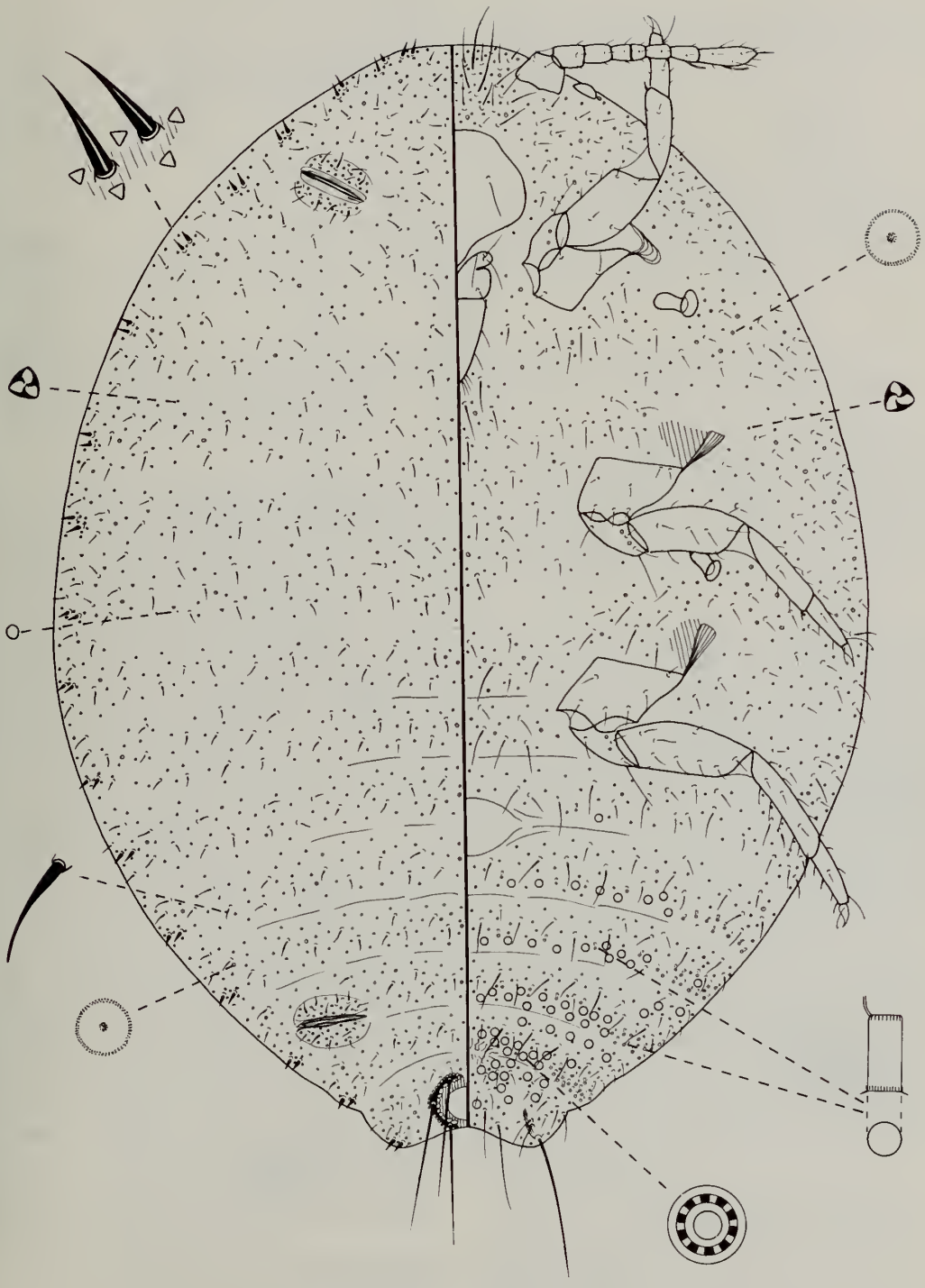

Fig. 2 *Planococcus aemulor* De Lotto.

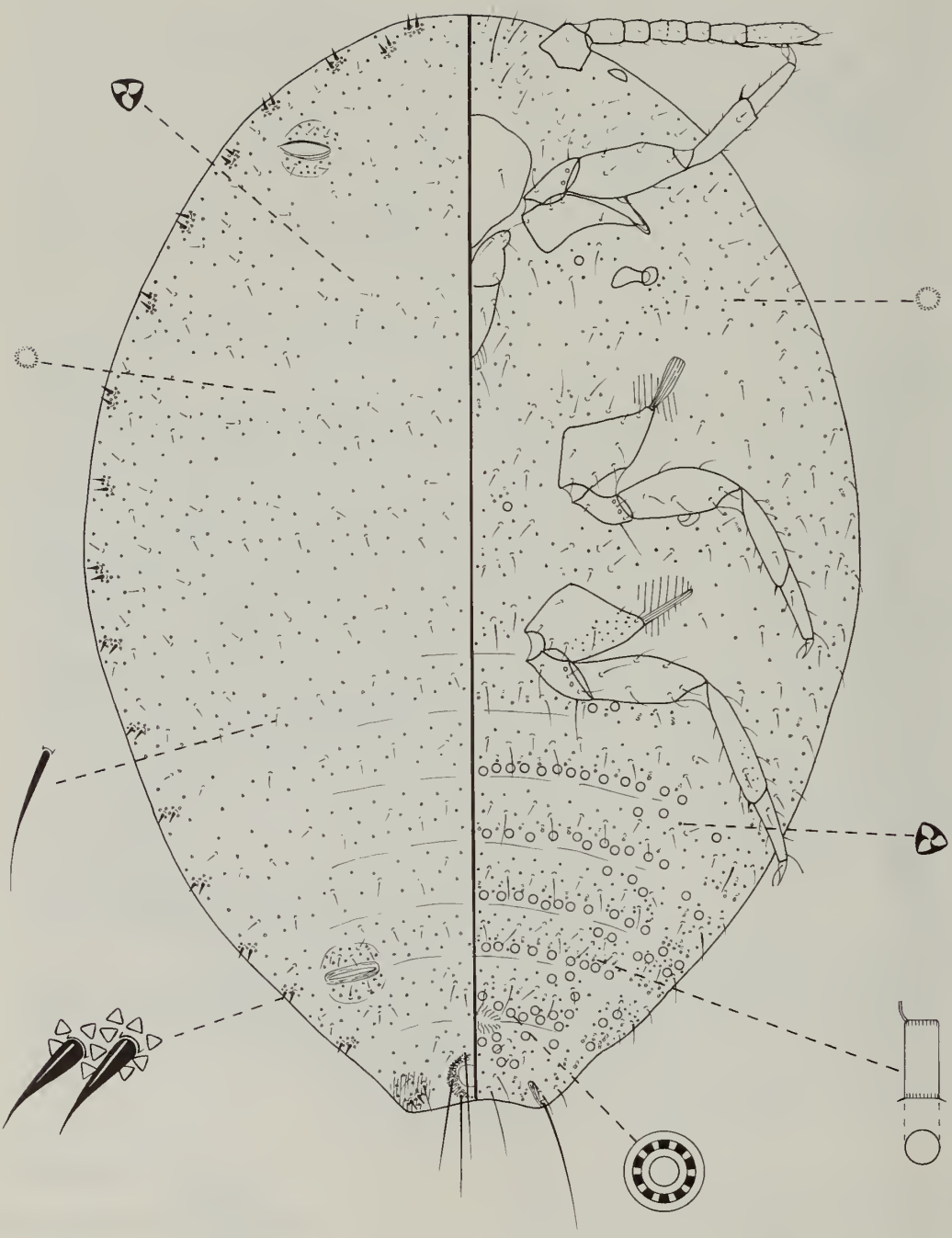

Fig. 3 *Planococcus aphelus* De Lotto.

from *P. aemulor*. The complete lack of tubular ducts on the thorax in *P. aemulor* together with the short, stout, blunt-ended dorsal setae indicate that it may be related to the orchid-feeding *dendrobii*-group rather than to the *citri*-group.

The only other known species of *Planococcus* completely lacking translucent pores on the hind legs is *P. hospitus*.

Planococcus aphelus De Lotto

(Fig. 3)

Planococcus aphelus De Lotto, 1967: 16. Holotype ♀, SOUTH AFRICA: on roots of *Phylica* sp. (SANC) [not examined].

ADULT FEMALE. Mounted specimens oval, length about 1.4 mm, width about 0.9 mm. Antennae 7- or 8-segmented, if 7-segmented, then pseudoarticulation apparent on segment IV. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 slender conical setae. Legs elongate; hind trochanter + femur 230–265 μm long, hind tibia + tarsus 230–280 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur about 1.06; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles moderately sclerotized. Circulus absent. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a moderately sized, moderately sclerotized area.

Venter. Multilocular disc pores present sparsely around vulva, in single rows across posterior edges of abdominal segments II-VII, a few present on anterior edges of segments V-VII, present singly or in small groups on margins of at least some abdominal segments, and sparsely scattered over median areas of thorax. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts apparently of 1 size, present sparsely in rows across median areas of abdominal segments II-VII, in small marginal groups on segments II-VIII, scattered over median area of thorax, and present singly on the margins of some thoracic segments. Simple pores considerably smaller than the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores and simple pores as for venter. Setae flagellate and of moderate length, longest seta on abdominal segments VI or VII 25–35 μm long.

MATERIAL EXAMINED

South Africa: 2 paratype ♀, Cape Province, Somerset West, on roots of *Phylica* sp., 26.xi.1964 (*J. Munting*) (BMNH).

DISTRIBUTION. Afrotropical Region: South Africa.

HOSTPLANT. Rhamnaceae: *Phylica* sp.

REMARKS. The distribution of the multilocular disc pores shows this species to be a member of the *citri*-group. It differs from the other members of this group by lacking a circulus.

Planococcus boafoensis (Strickland)

(Fig. 4)

Tylococcus boafoensis Strickland, 1947: 151; Williams, 1958: 30. Syntypes ♀, GHANA: on *Musanga smithii* (BMNH) [11 syntypes examined].

Planococcus boafoensis (Strickland) De Lotto, 1964: 372.

ADULT FEMALE. Mounted specimens elongate-oval, length 1.3–2.2 mm, width 0.6–1.3 mm. Margin of body with complete series of 18 pairs of cerarii situated on sclerotised protuberances, each cerarius with 2 (sometimes 3 on head and/or thorax) slender conical setae. Legs elongate; hind trochanter + femur 215–265 μm long, hind + tibia tarsus 225–275 μm long, ratio of lengths of hind + tibia tarsus to hind trochanter + femur 1.04–1.08; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate or oval, width 50–70 μm. Cisanal setae shorter than anal ring setae.

Venter. Multilocular disc pores confined to median areas of abdomen, sparsely present around vulva and in a single row across posterior edge of abdominal segment VI. Trilocular pores very sparse and evenly distributed. Oral collar tubular ducts of 1 size, confined to abdomen, a few present on median areas and margins of abdominal segments VI or VII. Simple pores apparently absent.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores somewhat sparse with 1–3 pores associated with the bases of the larger setae. Simple pores about a third of the size of the trilocular pores, sparsely but evenly distributed. Setae short and stout, almost lanceolate, longest seta on abdominal segments VI or VII 12–16 μm long.

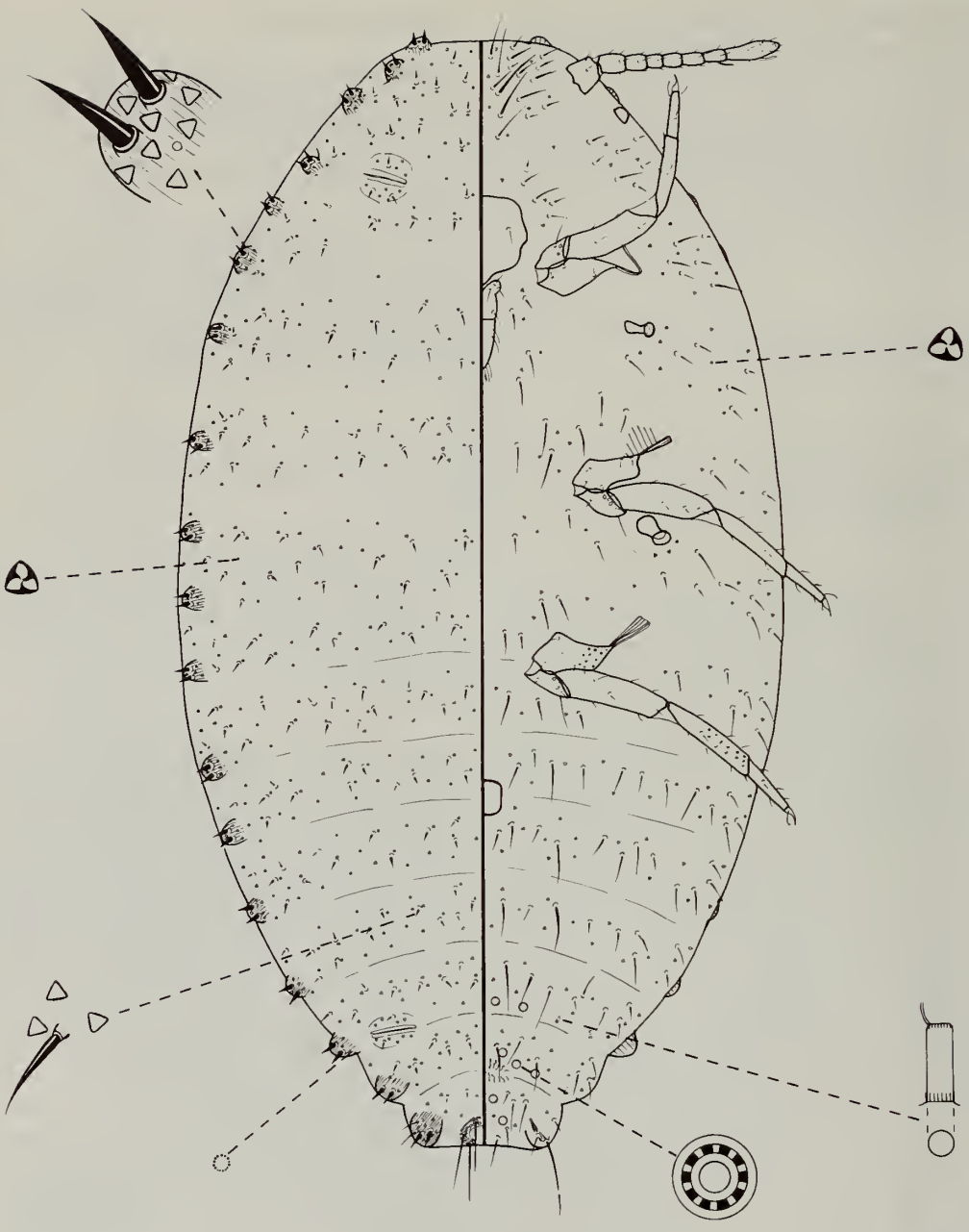

Fig. 4 *Planococcus boafoensis* (Strickland).

MATERIAL EXAMINED

12 ♀ (including type specimens listed below) (BMNH, MNNH).

Ghana (Gold Coast): 11 syntype ♀, Tafo, on *Musanga smithii*, 8.xi.1945 (*E. O. Boafo*) (BMNH).

DISTRIBUTION. Afrotropical Region: Ghana, Zaire.

HOSTPLANTS. Urticaceae: *Musanga cecropioides, M. smithii*.

REMARKS. This species is readily recognizable amongst the other known species of *Planococcus* by the sclerotised protuberances which bear the cerarii. Its relationships are difficult to determine, but it resembles the *dendrobii*-group in its distribution of multilocular disc pores and oral collar tubular ducts. *Cyperia angolia* De Lotto has very

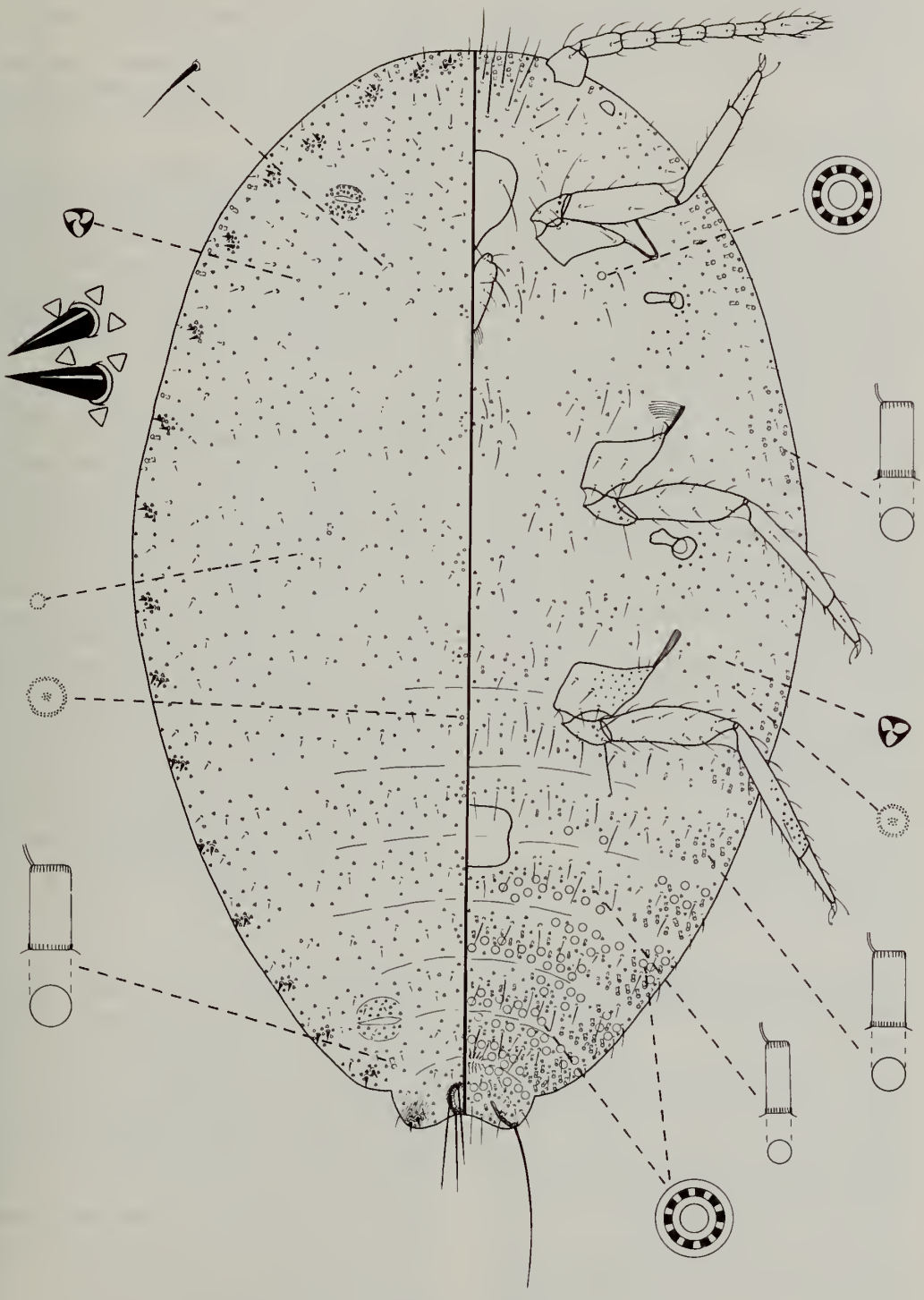

Fig. 5 *Planococcus citri* (Risso).

similar sclerotized protuberances, but differs in having flagellate auxiliary setae and more than 2 conical setae in most of the cerarii, and by having much longer dorsal setae than *Planococcus boafoensis*.

Planococcus citri (Risso)

(Fig. 5)

Dorthesia citri Risso, 1813: 416. Syntypes ♀, France: Menton, on *Citrus* sp. (probably lost).
Coccus citri (Risso) Boisduval, 1867: 348.
Dactylopius citri (Risso) Signoret, 1875: 312.
Lecanium phyllococcus Ashmead, 1879: 160. U.S.A.: Florida, on orange trees (status of type material not known). [Synonymy by Riley, 1888.]
Dactylopius destructor Comstock, 1881: 342. U.S.A.: Florida, on orange trees (status of type material not known). [Synonymy by Penzig, 1887.]
Phenacoccus spiriferus Hempel, 1900: 389. Syntypes ♀, Brazil: on cultivated tree (MZSP) [5 syntypes examined]. **Syn. n.**
Phenacoccus spiniferis Hempel; Hempel, 1901a: 110. [Misspelling.]
Pseudococcus citri (Risso) Fernald, 1903: 99.
Pseudococcus citri var. *phenacocciformis* Brain, 1915: 116. Syntypes ♀, South Africa: on *Bouvardia* sp. (SANC) [not examined]. [Synonymy by Ezzat & McConnell, 1956.]
Pseudococcus citri var. *coleorum* Marchal, 1908: 236. Syntypes ♀, France: on *Coleus* sp. (BMNH, MNNH) [4 syntypes examined]. [Synonymy by Borchsenius, 1949.]
Planococcus citri (Risso) Ferris, 1950: 165; Ezzat & McConnell, 1956: 65; Cox & Freeston, 1985: 722.
Planococcus citricus Ezzat & McConnell, 1956: 69. Holotype ♀, Italy (intercepted in U.S.A.): on *Citrus limonia* (USNM) [examined]. [Synonymy by Cox, 1981.]
Planococcoides cubanensis Ezzat & McConnell, 1956: 55. Holotype ♀, Cuba (intercepted in U.S.A.): on *Ficus pandurate* (USNM) [examined]. **Syn. n.**
Planococcus cucurbitae Ezzat & McConnell, 1956: 71. Holotype ♀, Grenada: on *Cucurbita* sp. (USNM) [examined]. **Syn. n.**

Adult female. Mounted specimens oval, length 1.6–3.2 mm, width 1.0–2.0 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 conical setae, except for preocular cerarii which may have 1 or 3 setae each. Legs elongate; hind trochanter + femur 220–350 μm long, hind tibia + tarsus 260–420 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.1–1.3; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles moderately sclerotized. Circulus quadrate, width 120–200 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores present around vulva, in single or double rows across posterior edges of abdominal segments III-VII, in single rows across anterior edges of segments V-VII, in marginal groups on abdominal segments IV-VII and sometimes a few pores scattered over median area of the thorax and head, but no more than a total of 6 pores behind the front coxae. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments I-VII; larger ducts in marginal groups of variable size around entire venter including head and thorax, and scattered over median area of thorax. Simple pores about the same size as the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores absent. Tubular ducts without apparent rims and slightly larger than the larger ducts on the venter, often present adjacent to some cerarii, 1 or 2 ducts sometimes present on median areas. Trilocular pores as for venter. Simple pores of 2 sizes, smaller pores smaller than the smaller size on the venter, scattered over entire dorsum, larger pores about twice the size of the trilocular pores, present in small groups along mid-line of thoracic and anterior abdominal segments. Setae flagellate and of moderate length, longest seta on abdominal segments VI or VII 30–35 μm long.

Material examined.
Several hundred field-collected adult females from many countries and host-plants in addition to the reared material used by Cox (1983) (BMNH, MNHN, USNM, VCI).
Planococcus spiriferus Hempel. 5 syntype ♀, on one slide labelled 'Phenacoccus spiniferus n. sp. Type ♀ 336'. The original description gives the habitat as Sao Paulo, in the grooves of leaves of a cultivated tree.
Planococcus citricus Ezzat & McConnell. Holotype ♀, **Italy** (intercepted at New York, Hidalgo): on *Citrus limonia*, 20.vii.1948 (USNM).
Planococcoides cubanensis Ezzat & McConnell. Holotype ♀, **Cuba** (intercepted at Hoboken, New Jersey): on *Ficus pandurate*, 11.vi.1948 (*Bennatt*) (USNM).

Planococcus cucurbitae Ezzat & McConnell. Holotype ♀, **Grenada**: on *Cucurbita* sp., 2.i.1944 (*R. G. Fennah*) (USNM).

DISTRIBUTION. Almost worldwide, but apparently absent from some South Pacific Islands and from the Malagasian Region.

HOSTPLANTS. Although *P. citri* is generally regarded as being polyphagous, which is indeed the case in greenhouses, in the field it is noticeably absent from certain host-plants. Thus De Lotto (1975) recorded that *P. citri*, although common on citrus in South Africa, was never found on grapevines. The mealybug found on vines throughout the Mediterranean basin is *P. ficus* and not *P. citri*.

REMARKS. Although there is no extant type material of *P. citri*, the identity of this species is not in question. Risso's original illustration of the live insect clearly shows it to be *Planococcus*, and the only species of this genus found on *Citrus* spp. in the Mediterranean Basin is *P. citri*. In fact, this species is well fitted to both its specific name 'citri and its common name, 'citrus mealybug', in that it shows a decided preference for this host throughout its geographical range.

Other species of *Planococcus* have been misidentified as *P. citri*. The very similar *P. minor* was only differentiated by rearing experiments studying the variation of both species (see Introduction) but is now known to be the predominant species in the South Pacific Islands, the Austro-oriental Region, the Malagasian Region and the northern Neotropical Region (Cox, 1981; Williams, 1982; Cox & Freeston, 1985). At one time *P. kenyae* was misidentified as *P. citri* and parasites sought in California for its control on coffee in Kenya (see under Remarks for this species). For a long time the distinction between *P. citri* and *P. ficus* was unclear, but the separation of these two species is now universally accepted (Ezzat & McConnell, 1956; De Lotto, 1975; Danzig, 1977; Cox, 1981).

P. citricus was considered by Ezzat & McConnell (1956) to differ from *P. citri* by having smaller appendages and fewer pores and ducts. Cox (1983) showed that these characteristics could be readily induced in *P. citri* by rearing specimens at high temperatures.

The syntypes examined of *Phenacoccus spiriferus* have numerous tubular ducts on the margins of the head and the thoracic segments, and are clearly *P. citri*. In the original description, the antennae are stated as being 9-segmented, but those of the syntypes are 8-segmented, with a slight pseudo-articulation indicated on the eighth segment – the measurements of the antennal segments given by Hempel show the eighth segment to comprise his eighth and ninth segments

Planococcoides cubanensis was described from a single specimen by Ezzat & McConnell (1956). It differs from normal *Planococcus citri* only by having three conical setae in each anal lobe cerarius. As no other similar specimens have been observed, and as *Planococcus* is apparently not native to the New World, this individual is here considered to be an aberrant specimen of *P. citri*.

P. curcurbitae was described from a single specimen by Ezzat & McConnell (1956). This specimen is heavily parasitized, and its main distinction from *P. citri* is that its anal ring setae are only about as long as the diameter of the anal ring. This characteristic has not been observed in any other specimen of *Planococcus* and is considered here to be an aberration. By the criteria given in Table 1, this specimen has been identified as *P. citri*, rather than *P. minor*, which it also resembles.

Morrison (1925) synonymized *Dactylopius calceolariae* var. *minor* with *Planococcus citri*. However, examination of the type material of this species has revealed that it is conspecific with a subsequently described species, *P. pacificus* Cox. No specimens of *P. citri* from the Malagasian Region have been observed during the course of this study.

ECONOMIC STATUS. *P. citri* is a serious pest of citrus in most citrus-growing areas of the world and is a major greenhouse pest in cooler regions.

Planococcus dendrobii Ezzat & McConnell

(Fig. 6)

Planococcus dendrobii Ezzat & McConnell, 1956: 73. Holotype ♀, INDIA (intercepted at Honolulu): on *Dendrobium transparens* (USNM) [not examined].

ADULT FEMALE. Mounted specimens rotund, length 1.7–2.6 mm, width 1.2–2.0 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 stout conical setae. Legs stout; hind trochanter + femur 235–280 μm long, hind tibia + tarsus 220–250 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.88–0.94; translucent pores apparent on hind coxae only. Inner edges of ostioles moderately strongly sclerotized. Circulus small and oval, width 75–115 μm. Cisanal setae shorter than anal lobe setae. Anal lobes not sclerotized.

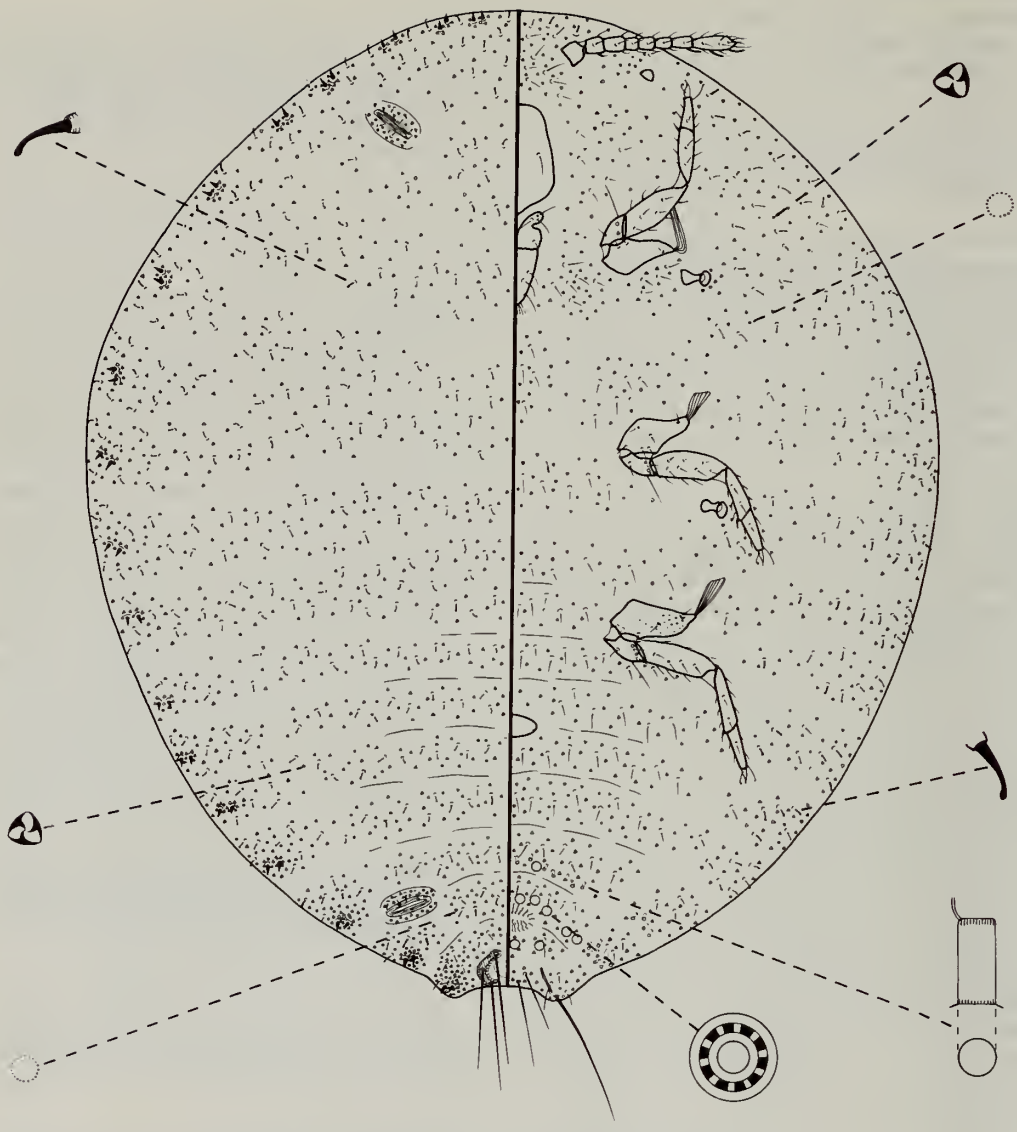

Fig. 6 *Planococcus dendrobii* Ezzat & McConnell.

Venter. Multilocular disc pores confined to median areas, present around vulva and in a single row across posterior edge of median area of abdominal segment VI. Trilocular pores numerous and evenly distributed. Oral collar tubular ducts of 1 size, confined to abdomen, present sparsely around vulva, a few ducts sometimes present on median area of segment V and in marginal groups on segments VI & VII. Simple pores slightly smaller than the trilocular pores, sparsely scattered over entire venter. Setae flagellate and moderately short on median areas, stout and knobbed on margins.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores generally as for venter, but more numerous on median areas of posterior abdominal segments. Setae short, stout and distinctly knobbed, length of longest seta on abdominal segments VI or VII 13–15 μm.

MATERIAL EXAMINED

10 ♀ (including type material listed below) (BMNH, USNM).

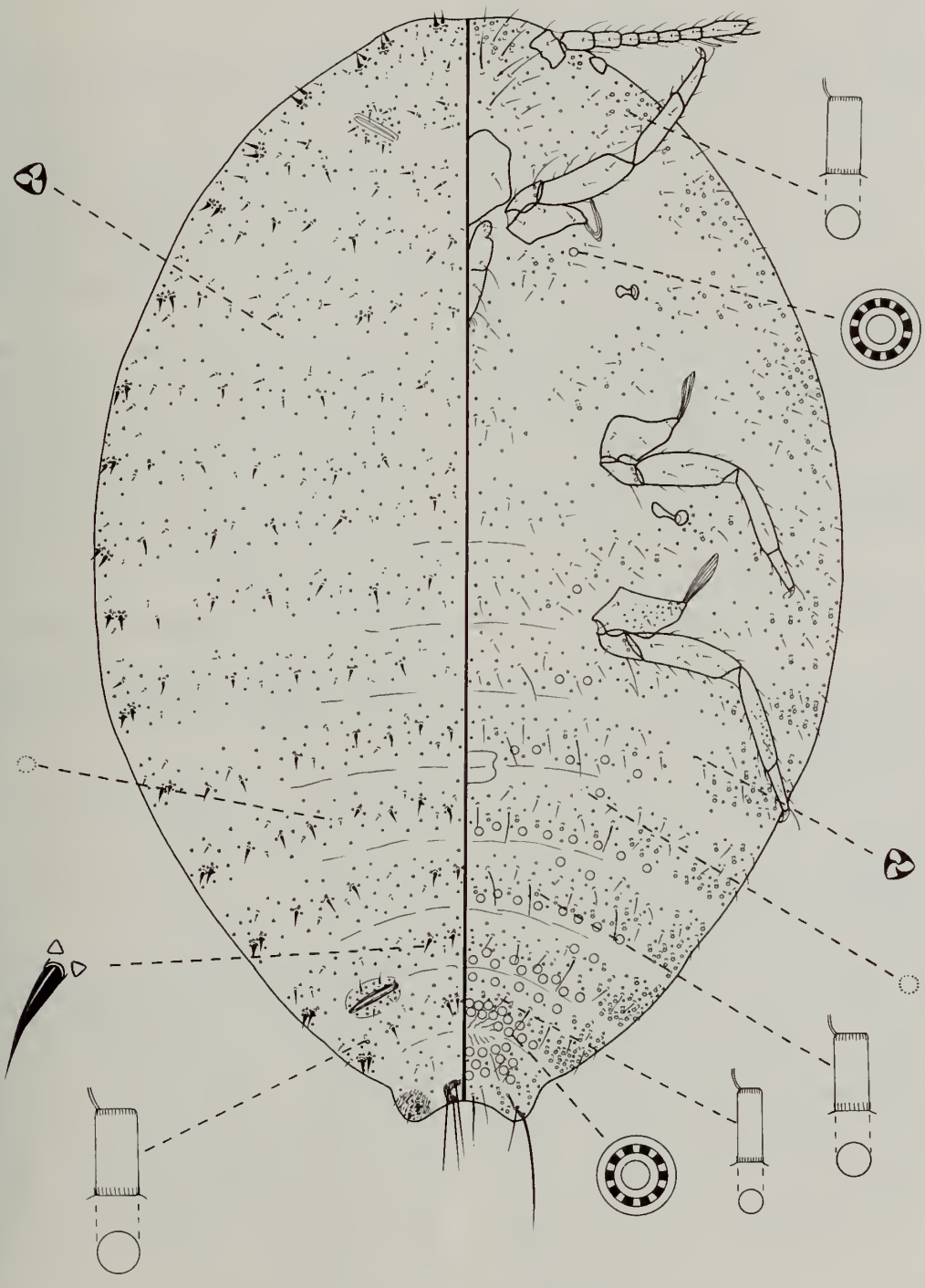

Fig. 7 *Planococcus dioscoreae* Williams.

India (intercepted at Honolulu): 2 paratype ♀, on *Dendrobium moschatum*, 16.iv.1947 (*S. Namiki*) (USNM).

Distribution. Oriental Region: Bhutan (intercepted at Edinburgh), India (intercepted at Honolulu). Also recorded from the Philippines and Thailand (Ezzat & McConnell, 1956).

Hostplants. Orchidaceae: *Dendrobium moschatum*. Also recorded from *D. fimbriatum*, *D. transparens* and *Cypripedium* sp. (all Orchidaceae) (Ezzat & McConnell, 1956).

Remarks. This species is very similar to *P. philippinensis*, having reduced numbers of multilocular disc pores and tubular ducts, dorsal setae knobbed and translucent pores absent from hind tibiae. The two species may be distinguished by the presence of a circulus in *P. dendrobii* and by the smaller simple pores on the dorsum of the posterior abdominal segments in this species. See also under *P. hospitus* for further remarks.

Economic status. This species is a potential pest of orchids.

Planococcus dioscoreae Williams

(Fig. 7)

Planococcus dioscoreae Williams, 1960: 39. Holotype ♀, Papua New Guinea: on yam (BMNH) [examined].

Adult female. Mounted specimens oval to broadly oval, length 2.0–2.5 mm, width 1.2–2.0 mm. Margin of body with a complete series of 18 distinct pairs of cerarii, each cerarius with 2 conical setae except for the preocular cerarii with 2 or 3 setae, all cerarian setae elongate-conical and with flagellate tips. Legs elongate, hind trochanter + femur 220–285 μm long, hind tibia + tarsus 235–285 μm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.00–1.08; translucent pores visible on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate and of moderate size, width 65–170 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotised area.

Venter. Multilocular disc pores confined to median areas, present around vulva, in single rows across posterior borders of abdominal segments II-VII and anterior borders (sometimes reduced to 1 or 2 pores per segment in small specimens) of abdominal segments III-VII or IV-VII, and a few spores scattered over median areas of thorax. Trilocular pores sparsely but evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present in rows across median areas of abdominal segments VI or VII; larger ducts present in rows across abdominal segments III-V, scattered over median areas of thorax, and present in groups around entire venter, including a group adjacent to each postocular cerarius. Simple pores about half the size of the trilocular pores, sparsely scattered over entire venter.

Dorsum. Multilocular disc pores absent. Trilocular pores moderately numerous and aggregated around bases of enlarged setae. Tubular ducts, larger than the larger ducts on the venter and without apparent rims, sometimes present singly next to some abdominal cerarii, no more than 2 present on any specimen and frequently absent. Simple pores as for venter. Dorsal setae of various sizes, larger setae elongate-conical with a flagellate apex, about the same size as the cerarian setae and each with 2–4 trilocular pores associated with their bases giving the appearance of dorsal cerarii, these enlarged setae present on all segments except the last and usually solitary with no more than 4 pairs present.

Material examined

53 ♀ (including type material listed below) (all BMNH).

Holotype ♀, **Papua New Guinea**: Sepik District, Bunahoj, on yams, 22.vi.1959 (*J. J. H. Szent-Ivany*). Paratypes, 32 ♀, same data except various villages, 22.v.-23.vi.1959.

Distribution. Austro-oriental Region: Papua New Guinea, Solomon Islands.

Hostplants. Dioscoreaceae: *Dioscorea* sp. (yams), *D. alata*. Araceae: *Xanthosoma sagittifolium*.

Remarks. The enlarged dorsal setae with associated aggregations of trilocular pores place this species in the *dorsospinosus*-group. It differs from both of the other two species in this group, *P. dorsospinosus* and *P. litchi*, by having 3–10 ventral tubular ducts adjacent to each post-ocular cerarius; from *P. dorsospinosus* by having larger and more flagellate dorsal setae; and from *P. litchi* by having the dorsal setae associated into no more than 4 pairs. *P. dioscoreae* is particularly close to *P. dorsospinosus*, and the specimens from India on yams listed under the latter species are somewhat intermediate in their characteristics. The whole group needs further study to clarify the relationship between these two species.

Economic status. This species has been found heavily infesting yams.

Planococcus dorsospinosus Ezzat & McConnell

(Fig. 8)

Planococcus dorsospinosus Ezzat & McConnell, 1956: 75. Holotype ♀, China (intercepted in U.S.A.): on *Pueraria hirsuta* (USNM) [examined].

Planococcus myrsinephilus Borchsenius, 1962: 585. Holotype ♀, China: on *Myrsine africana* (ZIL) [not examined]. **Syn. n.**

Planococcus sinensis Borchsenius, 1962: 586. Holotype ♀, China: on *Buddleia officinalis* (ZIL) [not examined]. **Syn. n.**

Adult female. Mounted specimens oval, length 2.4–3.5 mm, width 1.3–2.1 mm. Margin of body with a complete series of 18 distinct pairs of cerarii, each cerarius with 2 conical setae except for the preocular cerarii each with 3 or 4 setae, all cerarian setae conical and with slightly flagellate tips. Legs elongate, hind trochanter + femur 245–370 μm long, hind tibia + tarsus 255–400 μm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.97–1.12; translucent pores visible on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate and of moderate size, width 85–130 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a moderately sized, well-sclerotized area.

Venter. Multilocular disc pores usually confined to median areas, rarely 1 or 2 pores present on margins of 1 or 2 posterior abdominal segments; present around vulva, in single or double rows across posterior edges of abdominal segments III-VI (sometimes also 1 or 2 pores also on segment II) and anterior edge of abdominal segment VI or VII (sometimes 1 or 2 pores also present on anterior border of segment V), and a variable number of pores scattered over thorax. Trilocular pores sparsely but evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts in rows across median areas of abdominal segments VI or VII; larger ducts in rows across abdominal segments III-VII, scattered over median areas of thorax and in marginal groups on all head, thoracic and abdominal segments; up to 4 ducts sometimes present adjacent to each postocular cerarius. Simple pores about half the size of the trilocular pores, sparsely scattered over entire venter.

Dorsum. Multilocular disc pores absent. Trilocular pores moderately numerous and aggregated around bases of enlarged setae. Tubular ducts, considerably larger than the larger ducts on the venter and without apparent rims, sometimes present singly next to some abdominal cerarii. Simple pores as for venter but very sparse. Dorsal setae of various sizes, conical and without flagellate apices, larger setae slightly smaller than the cerarian setae and each with 1–3 trilocular pores associated with their bases giving the appearance of dorsal cerarii; these enlarged setae present on all body segments except the last abdominal segment, generally occurring singly, but sometimes up to 4 pairs present, length of longest conical seta on abdominal segments VI or VII 15–20 μm.

Material examined

21 ♀ (including type material listed below (BMNH, USNM, ZIL).

Planococcus dorsospinosus Ezzat & McConnell. Holotype ♀, **China** (intercepted at San Francisco, U.S.A.): on *Pueraria hirsuta* (kudzu vine), 20.i.1947 (*F. L. Blane*); 1 paratype ♀, same locality, on *Colocasia esculentum*, 10.i.1947 (*F. M. Thompson*) (both USNM).

Planococcus myrsinephilus Borchsenius. 1 paratype ♀, **China**: Yunnan Province, near Siakwan, on leaves and small branches of *Myrsine africana*, 18.iv.1957 (*N. Borchsenius*) (ZIL).

Planococcus sinensis Borchsenius. 1 paratype ♀, **China**: Yunnan Province, near Siakwan, 17.iv.1957 (*N. Borchsenius*) (ZIL).

Distribution. Palaearctic Region: Japan (intercepted in U.S.A.). Oriental Region: China, Hongkong, India, Taiwan (intercepted in U.S.A.), Thailand (intercepted in U.S.A.). Austro-oriental Region: Philippines (intercepted in U.S.A.).

Hostplants. Aceraceae: *Acer* sp. (branches). Araceae: *Colocasia esculentum*. Dioscoreaceae: *Dioscorea* sp. (root). Euphorbiaceae: *Euphorbia longan*. Leguminosae: *Pueraria hirsuta*. Meliaceae: *Lansium domesticum* (fruit). Myrsinaceae: *Myrsine africana* (leaves and small branches). Myrtaceae: *Eugenia* sp. (fruit), *Psidium guajava*. Punicaceae: *Punica granatum* (fruit). Rubiaceae: *Coffea canephora* (roots). Also recorded from *Litchi* sp. (Sapindaceae) by Ezzat & McConnell (1956) and as *P. sinensis* on the leaves, branches and stems of *Ficus gibbosa*, *Morus* sp. (Moraceae), *Buddleia officinalis* (Buddleiaceae), *Rhus* sp. (Anacardaceae) and *Daphniphyllum* sp. (Daphniphyllaceae) by Borchsenius (1962).

Remarks. This species is very similar to *P. dioscoreae*, apparently differing only in having relatively smaller and stouter enlarged dorsal setae and by having no more than 4 tubular ducts

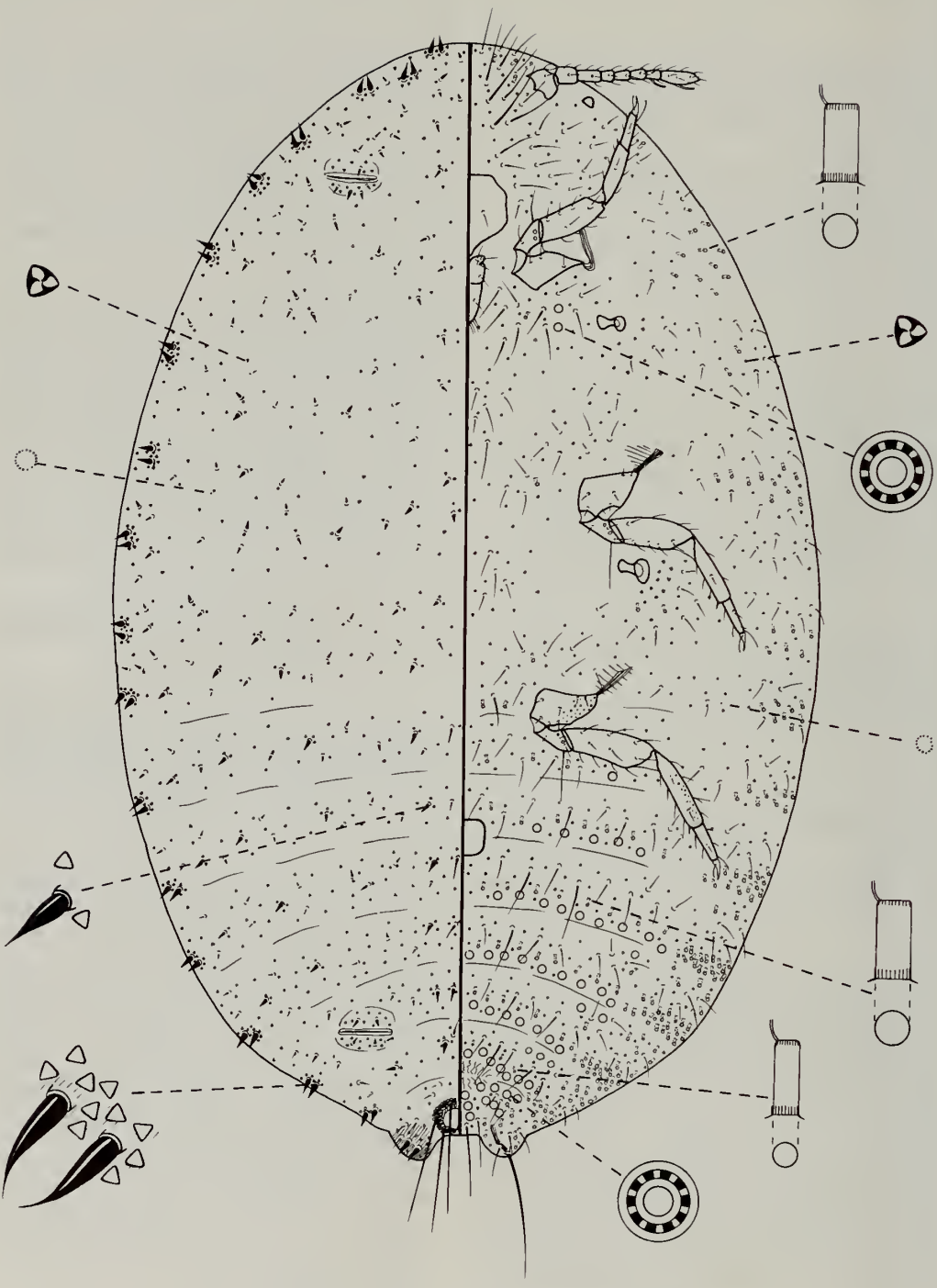

Fig. 8 *Planococcus dorsospinosus* Ezzat & McConnell.

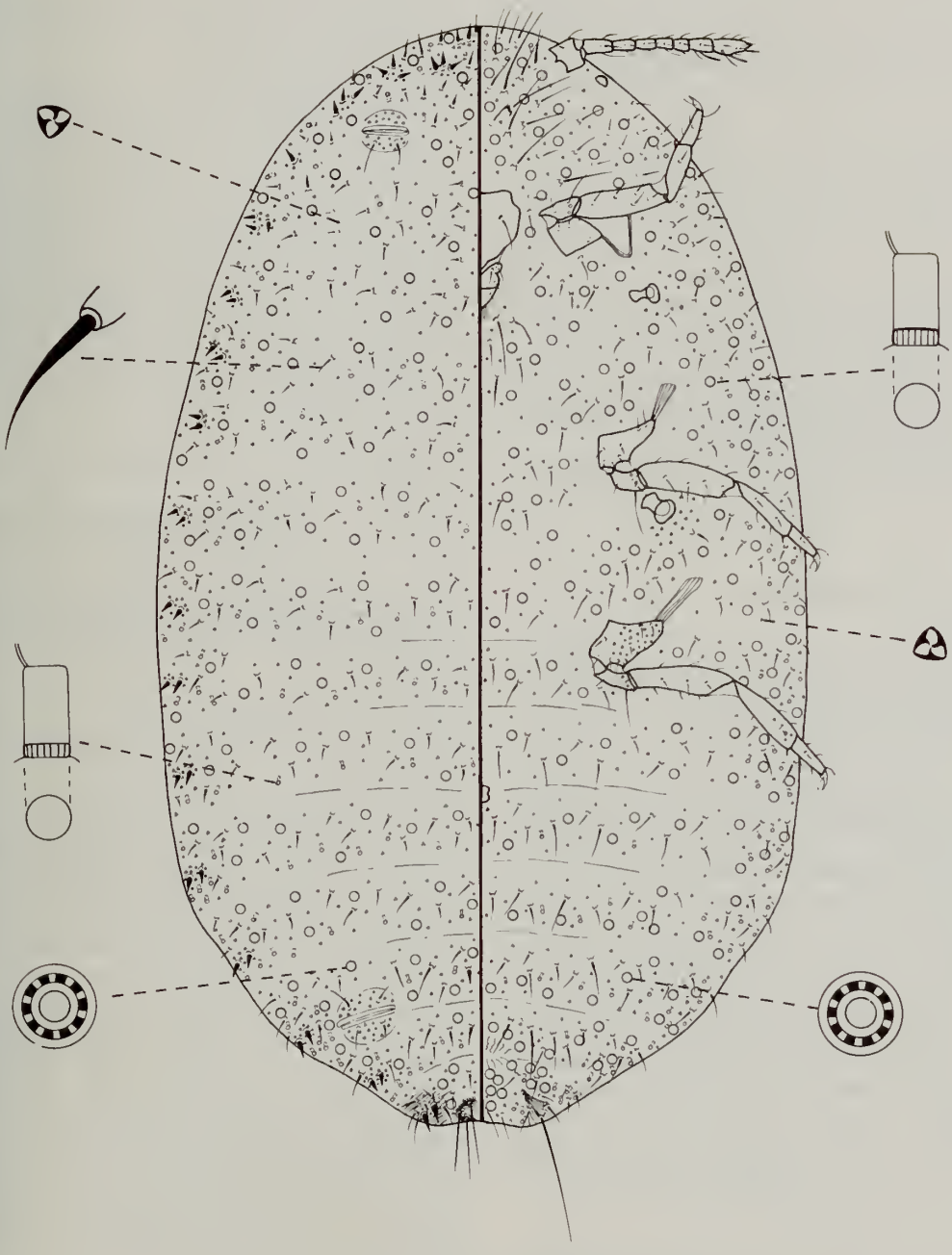

Fig. 9 *Planococcus dubius* Cox.

adjacent to each preocular cerarius. The specimens from *Dioscorea* and *Coffea robusta* roots listed above constitute the records from India. These specimens are somewhat intermediate in appearance between *P. dorsospinosus* and *P. dioscoreae* – more material from a wide area will be necessary to completely resolve this complex. Both of these species may be distinguished from *P. litchi* by having the enlarged dorsal setae associated into no more than 4 pairs. *P. dorsospinosus* appears to be somewhat variable, with larger specimens having wider bands of multilocular disc pores across the abdominal segments and more of these pores on the thorax. The apparent length of the dorsal setae is somewhat dependent on the preparation of the specimens onto microscope slides, as the flagellate tips are easily broken off. Borchsenius (1962) separated *P. sinensis* from *P. dorsospinosus* and *P. dioscoreae* by the lack of sclerotization of the anal lobes in the latter 2 species, but this character is also very dependent on the microscopic preparation

Economic status. This species is frequently intercepted on produce in the U.S.A.

Planococcus dubius Cox

(Fig. 9)

Planococcus dubius Cox, 1987: 75. Holotype o, NEW ZEALAND: on *Dracophyllum latifolium* (NZAC) [examined].

Adult female. Mounted specimens oval, length 2.4–3.2 mm, width 1.5–1.8 mm. Margin of body seldom with a complete series of 18 pairs of cerarii, 12–18 pairs, each cerarius with 1–4 conical setae on head and thorax, and 1 or 2 conical setae on the abdomen, occasionally a single flagellate auxiliary seta associated with one abdominal cerarius. Legs elongate; hind trochanter + femur 320–390 μm long, hind tibia + tarsus 310–360 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.93–1.00; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles moderately sclerotized. Circulus, if apparent, small and quadrate, width 40–50 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a moderately sized, well-sclerotised area.

Venter. Multilocular disc pores present around vulva, in single rows across posterior edges of median areas of abdominal segments V or VI, a few present on anterior edges of median areas of segments V-VII, and scattered over head, thorax and margins of entire body. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes, smaller ducts present sparsely in rows across median areas of abdominal segments IV-VII, larger ducts moderately numerous around margins of entire venter. Simple pores about half the size of the trilocular pores, sparsely scattered over entire venter. Setae somewhat long and stout.

Dorsum. Multilocular disc pores numerous over entire surface. Tubular ducts, the same size as the larger ducts on the venter and without aparent rims, sparse to moderately numerous over entire dorsum, forming rows across most body segments. Trilocular pores as for venter. Simple pores about a quarter of the size of the trilocular pores, sparsely scattered over entire dorsum. Setae generally long and with enlarged bases but almost conical on median areas of abdominal segments VI or VII, length of longest of these setae 23–30 μm.

Material examined

10 ♀ (including type material listed) (BMNH, NZAC).

Holotype ♀, **New Zealand**: Auckland, Waitakere Range, on *Dracophyllum latifolium*, 16.xi.1973 (*J.A. de Boer*) (NZAC). Paratypes, 2 ♀, same data as holotype (BMNH, NZAC); 1 ♀, **New Zealand**: Lake Waikaremoana, at base of leaves of *Dracophyllum* sp., 4.iii.1983 (*J. M. Cox*) (BMNH, NZAC).

Distribution. New Zealand only.

Hostplants. Epacridaceae: *Dracophyllum* sp., *D. latifolium*.

Remarks. *P. dubius* was placed in *Planococcus* by Cox (1987), despite usually having fewer than 18 pairs of cerarii, because most specimens have three pairs of cerarii anterior to the eyes and, taken as a group, the type specimens show cerarii in all the 18 possible positions on the body.

This species is very variable in its numbers of cerarii and multilocular disc pores. Moreover, the non-type material examined, collected in a different part of New Zealand from the type material, apparently lack circuli – these specimens may prove to be a different species when more material has been collected and examined.

The affinities of this species with other members of *Planococcus* are difficult to determine. The presence of flagellate auxiliary setae in one abdominal cerarius in some specimens suggests that this species may actually be closer to *Planococcoides* than to *Planococcus*. The only other species of *Planococcus* with dorsal multilocular disc pores is the African *P. epulus*, but the latter species has more flagellate dorsal setae on

abdominal segments VI VII and each cerarius is distinct and with 2 conical setae. *P. dubius* may be most closely related to the other species of *Planococcus* found in New Zealand, *P. mali* (although this species is suspected here of originating in Japan), as some cerarii are indistinct, the dorsal setae are stout and some of the cephalic and thoracic cerarii have more than 2 conical setae. However, it is also close to the New Zealand species placed by Cox (1987) in *Paracoccus*, all of which have oral rim tubular ducts and, except for *P. zealandicus* (Ezzat & McConnell), substantially fewer than 18 pairs of cerarii. The presence of oral rim tubular ducts does not, in itself, exclude *P. zealandicus* from *Planococcus*, but it was placed in *Paracoccus* by Cox (1987), despite sometimes having 18 pairs of cerarii, as it is clearly congeneric with some of the other New Zealand species placed in *Paracoccus* such as *P. drimydis* (Brittin) and *P. glaucus* (Maskell). Eventually, when the generic concepts of mealybugs are better understood, these New Zealand species may require the erection of a new genus.

Planococcus epulus De Lotto

(Fig. 10)

Planococcus epulus De Lotto, 1964: 375. Holotype ♀ KENYA: on *Pterolobium lacerans* (BMNH) [examined].

ADULT FEMALE. Mounted specimen elongate-oval, length 1.7 mm, width 1.1 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 (rarely 1 on thorax) moderately stout conical setae. Legs elongate; hind trochanter + femur 315 μm long, hind tibia + tarsus 350 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.11; translucent pores present on hind tibiae but not apparent on hind coxae. Inner edges of ostioles not noticeably sclerotized. Circulus quadrate, width 145 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotised area.

Venter. Multilocular disc pores moderately numerous around vulva, present in rows across anterior and posterior edges of abdominal segments II-VII, in small marginal groups on segments III-VII and scattered over median areas of venter. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments VI or VII; larger ducts sparsely scattered over median areas of head and thorax, present in rows across median areas of abdominal segments, and in marginal groups around entire venter. Simple pores minute, sparsely but evenly distributed.

Dorsum. Multilocular disc pores sparsely scattered over thorax and abdomen. Tubular ducts of same form and size as the larger ducts on the venter, moderately numerous over entire dorsum. Trilocular pores and simple pores as for venter. Setae long and flagellate, longest seta on abdominal segments VI or VII about 45 μm long.

MATERIAL EXAMINED

Known from holotype ♀ only, **Kenya:** Nairobi, 7.1.1957, on *Pterolobium lacerans* (*G. De Lotto*) (BMNH).

DISTRIBUTION. Afrotropical Region: Kenya.

HOSTPLANT. Leguminosae: *Pterolobium lacerans*.

REMARKS. The only other known species of *Planococcus* with dorsal multilocular disc pores is *P. dubius* from New Zealand (see under Remarks for this species). In all other characters, *P. epulus* appears to be a member of the *P. citri*-group.

Planococcus ficus (Signoret)

(Fig. 11)

[*Coccus vitis* L.; Nedzel'skii, 1869: 19. Misidentification.]

Dactylopius ficus Signoret, 1875: 315. Syntypes ♀, FRANCE: on edible fig (probably lost).

[*Dactylopius vitis*; Lichtenstein, 1870: L. Misidentification.]

Dactylopius subterraneus Hempel, 1901b: 388. Syntypes ♀, ARGENTINA: on roots of cultivated grapes (VCCB) [1 syntype examined by D. J. Williams]. **Syn. n.**

Pseudococcus ficus (Signoret) Fernald, 1903: 101.

Pseudococcus subterraneus (Hempel) Fernald, 1903: 110.

[Pseudococcus vitis (Niedielski) Fernald, 1903: 112. Misidentification.]

Pseudococcus citrioides Ferris, 1922: 203. Holotype ♀, LIBYA: on ? (UCD) [examined]. [Synonymized by Cox & Ben-Dov, 1986.]

Planococcus citrioides (Ferris) Ferris, 1950: 164.

Planococcus ficus (Signoret) Ezzat & McConnell, 1956: 79.

[*Planococcus vitis* (Niedielski) Ezzat & McConnell, 1956: 103. Misidentification.]

ADULT FEMALE. Mounted specimens oval, length 1.4–3.2 mm, width 0.8–2.2 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 conical setae, more slender towards the anterior of the body. Legs elongate; hind trochanter + femur 235–355 μm long, hind

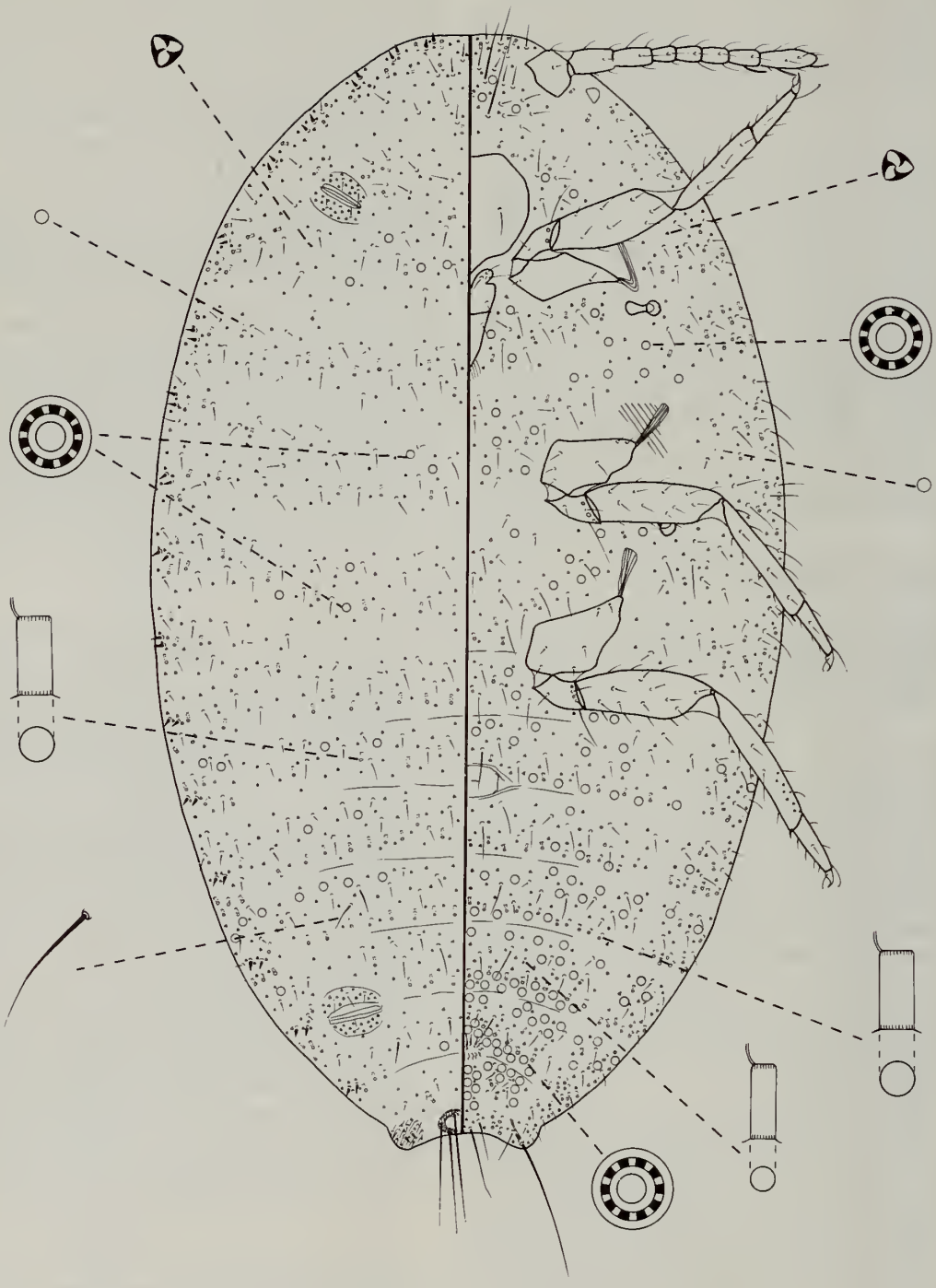

Fig. 10 *Planococcus epulus* De Lotto.

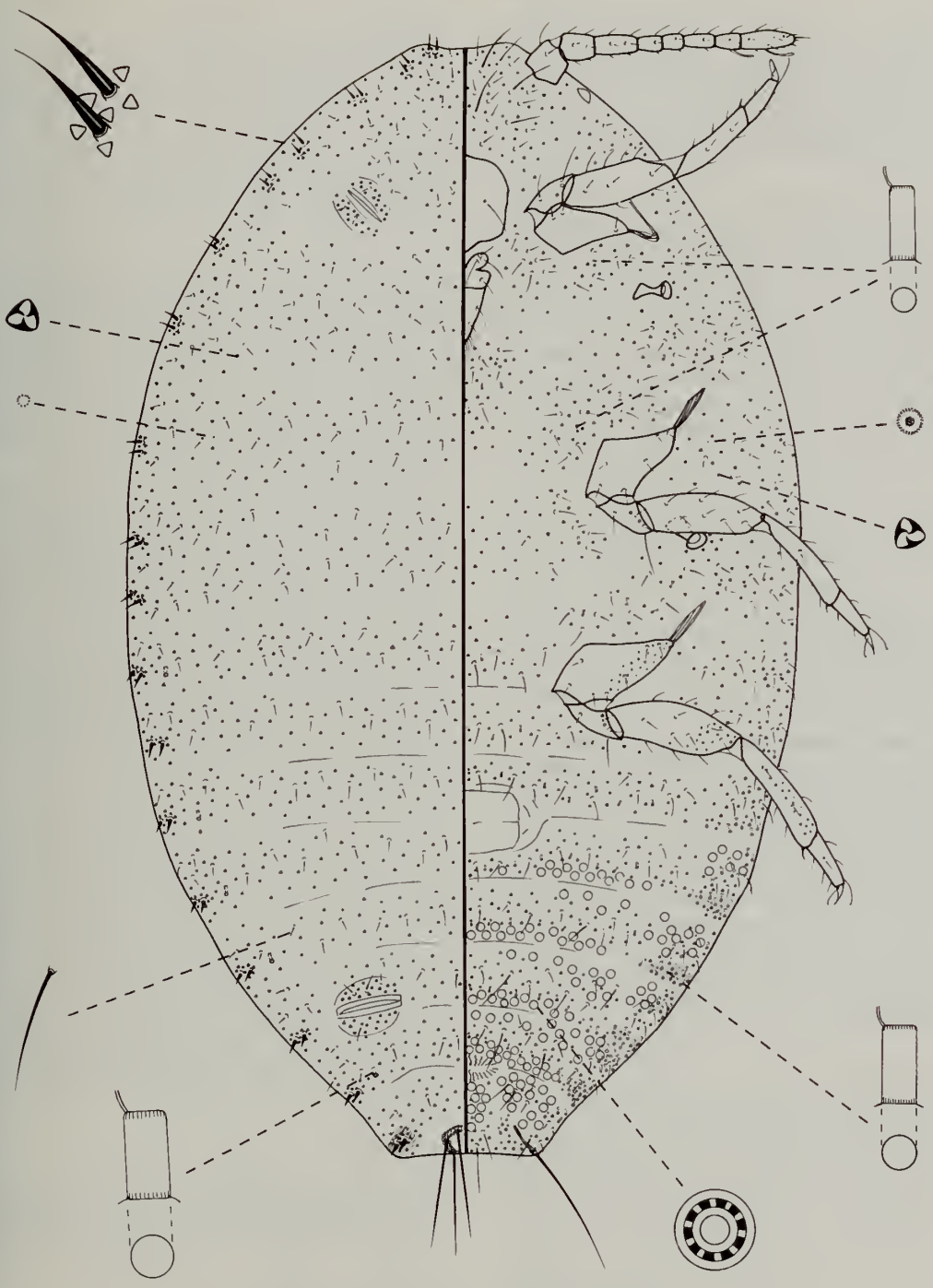

Fig. 11 *Planococcus ficus* (Signoret).

tibia + tarsus 275–395 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.01–1.17; translucent pores apparent on hind coxae and tibiae, and often also on hind femora. Inner edges of ostioles moderately sclerotized. Circulus quadrate, width 115–150 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores present around vulva; in single rows across posterior edges of abdominal segments III-VII or II-VII and across anterior edges of segments V-VII; in marginal groups on posterior abdominal segments, usually as far forward as segment II; often present in groups of up to 12 pores behind each front coxa; and sparsely scattered over median areas of the thorax. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments V-VII; larger ducts present sparsely in rows across median areas of abdominal segments II-VII, in marginal groups on segments II-VIII, scattered over median area of thorax, a single pore sometimes present on head, and up to 3 pores sometimes present on each margin of the thoracic segments. Simple pores slightly smaller to slightly larger than the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores absent. Tubular ducts, larger than those on the venter and frequently with distinct rims, usually occurring singly (rarely in pairs) adjacent to some or most cerarii. Trilocular pores as for venter. Simple pores of two sizes; larger pores, if apparent, larger than the trilocular pores, present in groups of 1–3 pores on mid-line of some thoracic and abdominal segments; smaller pores minute, scattered sparsely over entire dorsum. Setae long and flagellate, longest seta on abdominal segment VI or VII 23–50 μm long.

Material examined

About 50 ♀ (including type material listed) (BMNH, MNNH, UCD, USNM, VCI).

Pseudococcus citrioides Ferris. Holotype ♀, **Libya**: Cyrenaica Guarsia, on ?, 4.iv.1922 (*F. Silvestri*) (UCD); 2 paratype ♀, same data as holotype (UCD).

Distribution. Palaearctic Region: Cyprus, Egypt, France, Greece, Iran, Iraq, Israel, Italy, Lebanon, Libya, Saudi Arabia, Spain, Tunisia, Turkey. Afrotropical Region: South Africa. Oriental Region: Pakistan. Neotropical Region: Argentina.

Hostplants. Anacardaceae: *Mangifera indica*. Lauraceae: *Persea americana*. Leguminosae: *Dichrostachys glomerata, Prosopis fareta, Tephrosia purpurea*. Moraceae: *Ficus carica*. Palmae: *Phoenix dactylifera*. Punicaceae: *Punica granatum*. Rhamnaceae: *Zizyphus spina-christi*. Rosaceae: *Malus pumila*. Salicaceae: *Salix* sp. Styraceae: *Styrax officinale*. Vitidaceae: *Vitis vinifera*. Most of the specimens examined were from grapevines or, less commonly, figs.

Remarks. *P. ficus* was frequently misidentified as *P. citri* before the works of Ezzat & McConnell (1956) and De Lotto (1975), and most records of *P. citri* from grapevines should be referred to *P. ficus*. As discussed in detail by De Lotto (1975) and Cox & Ben-Dov (1986), the binomen *Plancoccus vitis* is invalid, and records under this name should be referred to *P. ficus*.

P. ficus is very similar to *P. halli* from the Afrotropical Region and the West Indies, where it is frequently found on yams. The distinction of these two species is discussed under the Remarks on *P. halli*. One of the most distinctive characters of *P. ficus*, the presence of translucent pores on the hind femora, is not apparent in many specimens. Cox & Wetton (in press), who reared this species, found that its expression was dependent on temperature, translucent pores being present on the hind femora of most specimens reared at high temperatures, but absent from most specimens reared at low temperatures

Dr D. J. Williams, C.A.B. International Institute of Entomology, examined and sketched a syntype of *Dactylopius subterraneus* Hempel during a recent visit to Brazil, and concluded that it was *P. ficus*. According to his notes and sketch, the specimen has elongate conical setae in the cephalic cerarii and 5 and 8 multilocular disc pores behind the respective front coxae. The original description states that the female is gall-forming, but it is more likely that the mealybug was merely occupying a vacated gall formed by some other organism.

Economic status. *P. ficus* is the common mealybug on grapevines throughout the Mediterranean Basin and now also occurs on this host in Argentina, Pakistan and South Africa. It will probably continue to spread to other areas where grapevines are grown.

Rosen & DeBach (1977) noted that the parasite fauna supported by the vine mealybug in Israel is significantly different from that of the citrus mealybug.

Planococcus flagellatus De Lotto

(Fig. 12)

Planococcus flagellatus De Lotto, 1961: 220. Holotype ♀, UGANDA: on roots of *Vernonia auriculifera* (BMNH) [examined].

ADULT FEMALE. Mounted specimens oval, length 1.7–3.2 mm, width 1.2–2.2 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 slender, often very elongate, conical setae. Legs elongate; hind trochanter + femur 255–335 μm long, hind tibia + tarsus 285–370 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.93–1.12; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus variable in size, small and round to larger and quadrate, width 15–160 μm. Cisanal setae variable, from shorter than (including type series) to longer than, anal ring setae. Anal lobe cerarii situated on small, moderately sclerotized areas.

Venter. Multilocular disc pores present around vulva, in single or double rows across posterior edges of median areas of abdominal segments I-VII or II-VII (occasionally absent from segments I-III), usually a few present on anterior edges of segments III-VII, present in small groups on margins of abdominal segments II-VII or III-VII (rarely reduced to a single pore on each side of each segment) and usually scattered over median areas of the thorax. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments II-VII; larger ducts present in marginal groups on head and all thoracic and abdominal segments, and scattered over median area of thorax. Simple pores slightly smaller than the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores absent. Tubular ducts, larger than the larger ducts on the venter and without apparent rims, usually present singly adjacent to some abdominal cerarii. Trilocular pores as for venter. Simple pores about a third of the size of the trilocular pores, present in small groups on mid-line of thoracic segments. Setae long and flagellate, 1 or 2 setae sometimes bifurcate, longest seta on abdominal segments VI or VII 40–100 μm long.

MATERIAL EXAMINED

14 ♀ (including type material listed below) (all BMNH).

Holotype ♀, **Uganda**: Sebei, on roots of *Vernonia auriculifera*, 18.ii.1957 (*D. N. McNutt*). Paratypes, 5 ♀, same data as holotype.

DISTRIBUTION. Afrotropical Region: Mozambique, Nigeria, Sudan, Uganda.

HOSTPLANTS. Occurring on the roots. Anacardaceae: *Anacardium occidentale* (cashew). Asteraceae: *Vernonia auriculifera*. Leguminosae: *Glycine max* (soya bean). Sterculiaceae: *Theobroma cacao*. Also recorded from the roots of *Cassia petersiana* (Leguminosae) by De Lotto (1964).

REMARKS. This species is clearly a member of the *P. citri*-group by virtue of its distribution of multilocular disc pores and tubular ducts. It is similar to *P. ficus* and *P. halli* which may also have long dorsal setae, but differs from both of these species by usually having numerous marginal tubular ducts on the head and thorax. It is most similar to *P. subterraneus*, known only from the holotype, which lacks tubular ducts on the head and has many bifurcate dorsal setae.

Planococcus furcisetosus Mamet

(Fig. 13)

Planococcus furcisetosus Mamet, 1959: 404. Syntypes ♀, MADAGASCAR: on ebenier (MNNH) [2 syntypes examined].

ADULT FEMALE. Mounted specimens broadly oval to rotund, length 1.6–1.8 mm, width 1.2–1.3 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 conical setae. Legs stout; hind trochanter + femur 235–260 μm long, hind tibia + tarsus 220–240 μm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur about 0.92; translucent pores present on hind coxae and tibiae. Inner edges of ostioles well sclerotized. Circulus small and round, width 55–70 μm. Cisanal setae shorter than anal lobe setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores confined to median areas of abdomen, present around vulva and in rows across posterior edges of median areas of abdominal segments III-VI. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts apparently of 1 size, present in rows across median areas of abdominal segments III-VII and in marginal groups on segments VII-IX. Simple pores not apparent on specimens examined.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores moderately numerous and evenly distributed. Simple pores slightly larger than the trilocular pores, present in small

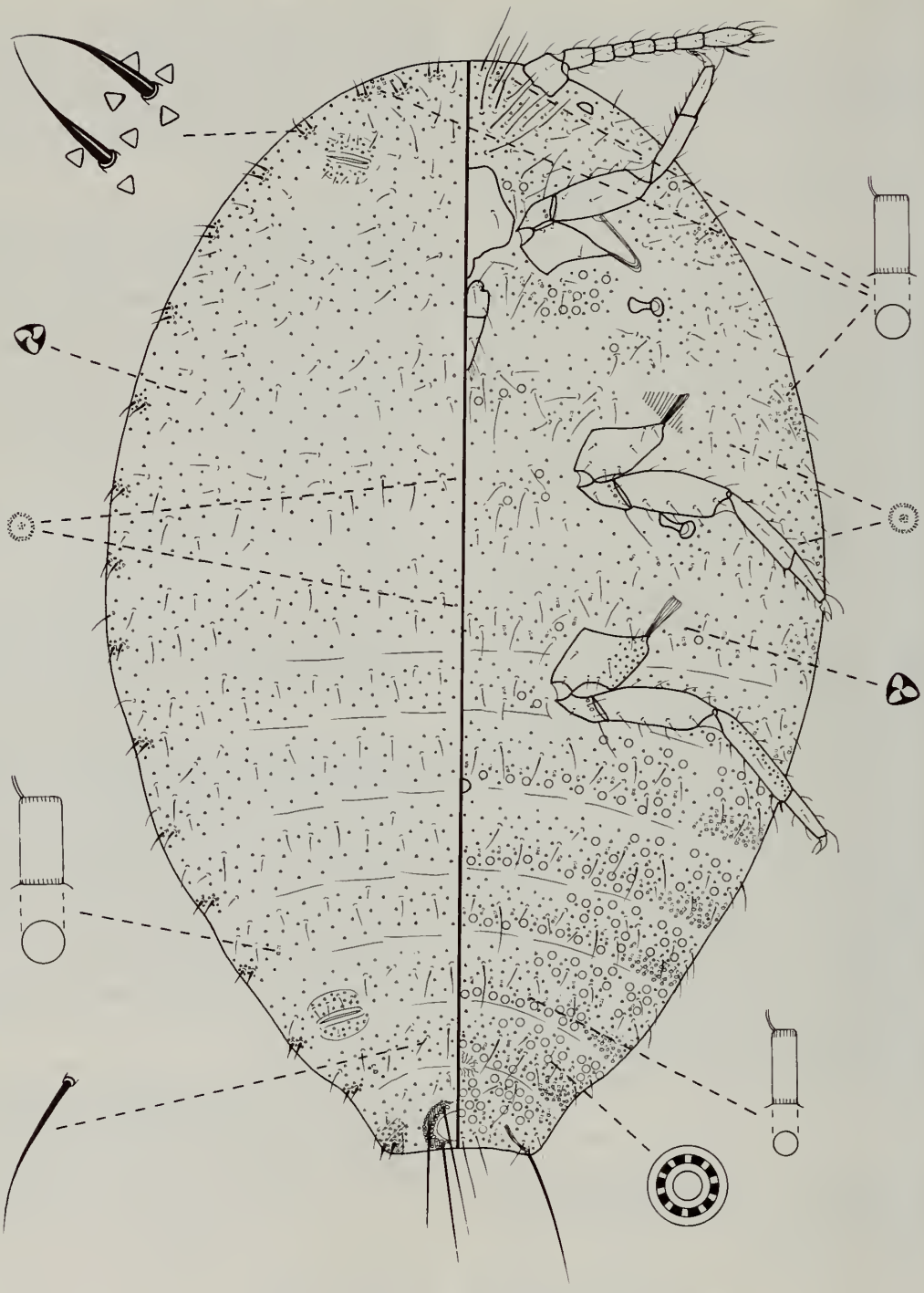

Fig. 12 *Planococcus flagellatus* De Lotto.

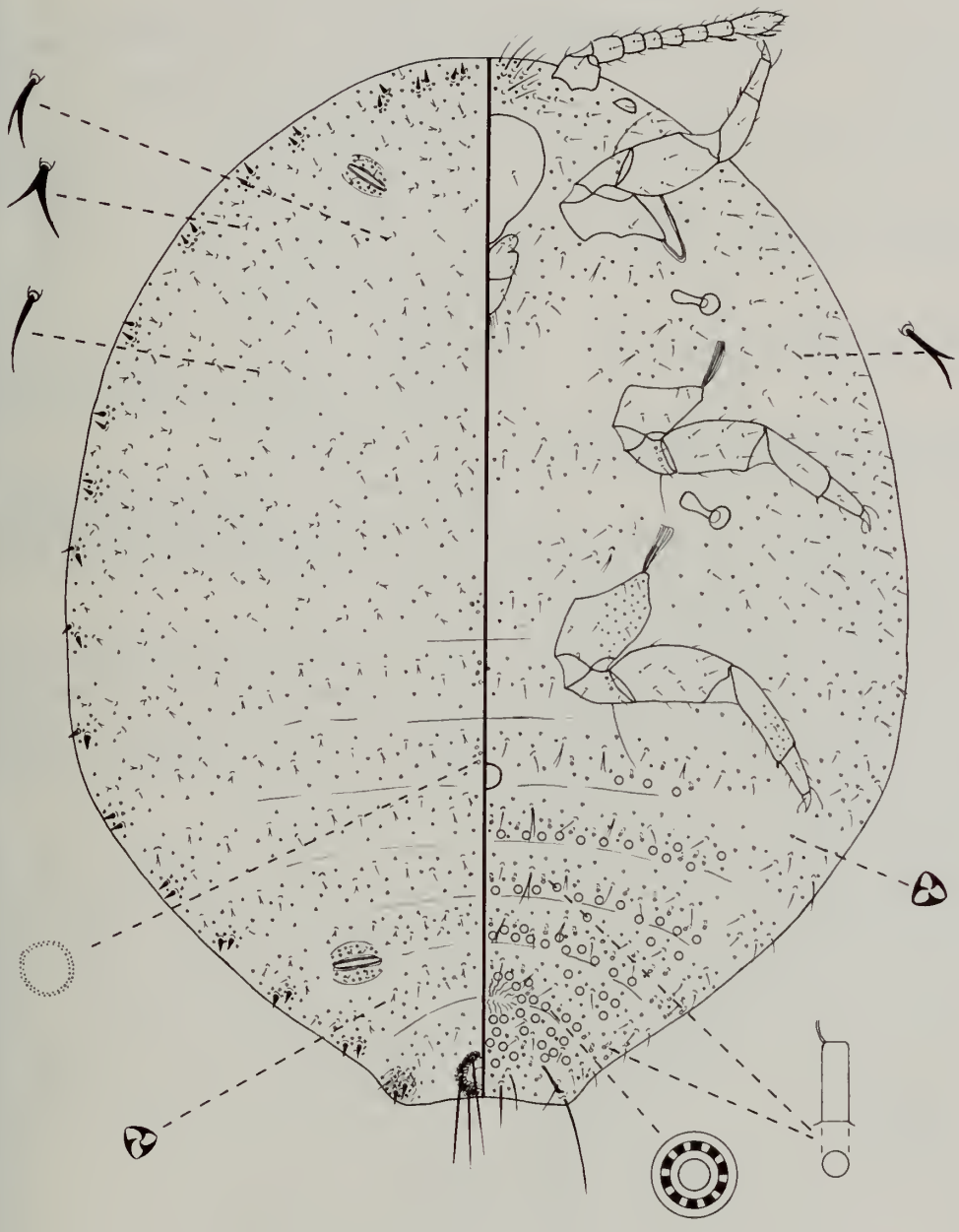

Fig. 13 *Planococcus furcisetosus* Mamet.

groups on the mid-line of the anterior abdominal segments. Setae short and stout, most furcate, longest seta of abdominal segments VI or VII 22–25 μm long.

MATERIAL EXAMINED
2 syntype ♀, **Madagascar**: Maroantsetra, Ambodivoany, on ebenier, iii.1952 (*R. Paulian*) (MNNH).

DISTRIBUTION. Malagasian Region: Madagascar.

HOSTPLANT. Ebenaceae: *Diospyros* sp.

REMARKS. The furcate dorsal setae distinguish *P. furcisetosus* from all other known species of *Planococcus*.

Planococcus halli Ezzat & McConnell (Fig. 14)

Planococcus halli Ezzat & McConnell, 1956: 81. Holotype ♀, ST KITTS: on *Dioscorea* sp. (USMN) [examined].

ADULT FEMALE. Mounted specimens oval, length 1.5–3.4 mm, width 0.9–2.4 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 conical setae which are more slender and flagellate towards the anterior end of the body. Legs elongate; hind trochanter + femur 220–335 μm long, hind tibia + tarsus 275–371 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.03–1.24; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate, width 55–180 μm. Cisanal setae shorter than anal lobe setae. Anal lobe cerarii each situated on a moderately sized, lightly sclerotized area.

Venter. Multilocular disc pores situated around vulva and in rows (usually single, except in very large specimens where they may be double) across posterior edges of median areas of abdominal segments II-VII or III-VII, in single rows across anterior edges of median areas of abdominal segments IV-VII, in marginal groups on either side of segments III-VII or IV-VII (rarely 1 or 2 pores present on margins of segment II), and a few pores sometimes scattered over median areas of head and thorax. Trilocular pores numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments VI or VII; larger ducts present in rows across median areas of segments II-VII, in marginal groups on abdominal segments I-IX, scattered over median areas of thorax, 1–3 ducts sometimes present on head and 1–6 ducts sometimes present on each side of each thoracic segment. Simple pores slightly smaller than the trilocular pores, scattered over entire venter.

Dorsum. Multilocular disc pores absent. Tubular ducts, if present, larger than those on the venter and without apparent rims, and present singly (rarely in 2s or 3s) adjacent to some abdominal cerarii. Trilocular pores as for venter. Simple pores of 2 sizes; larger pores slightly larger than the trilocular pores, present in small groups on mid-line of each abdominal segment; smaller pores minute, scattered over entire dorsum. Setae long and flagellate, length of longest seta of abdominal segments VI or VII 25–45 μm.

MATERIAL EXAMINED
About 100 ♀ (including holotype) (BMNH, USNM).
Holotype ♀, **St Kitts** (intercepted at Boston, Massachusetts): on *Dioscorea* sp., yam, 12.iii.1949 (*Hodson Hardy*) (USNM). Originally described from the holotype only.

DISTRIBUTION. Afrotropical Region: Cameroons, Ethiopia, Gabon, Ghana, Liberia, Nigeria, South Africa, Sudan. Neotropical Region: Barbados, Bermuda, Brazil, Guyana, Haiti, St. Kitts, Trinidad.

HOSTPLANTS. Celestraceae: *Gymnosporia spinosa*. Dioscoreaceae: *Dioscorea alata*, *D. rotundata*. Euphorbiaceae: *Manihot esculentum*. Leguminosae: *Arachis hypogaea* (groundnut). Poaceae: *Saccharum officinarum*. Rubiaceae: *Coffea canephora*. Most commonly encountered on yams (*Dioscorea* spp.).

REMARKS. *P. halli* is very similar to *P. ficus*, and some specimens may be impossible to identify by the characters given in the key. Cox & Wetton (in press) carried out multivariate analyses of specimens of this group from yams, pomegranates, figs and grapevines. The results showed that the specimens from yams were differentiated almost entirely from those from figs, pomegranates and grapevines, and that specimens from yams from the Ethiopian Region and from the West Indies were intermingled. That this differentiation was not merely a host effect was demonstrated by rearing material from each source on potato tubers. Cox & Wetton (in press) concluded that, as two names are available, the two groups should be regarded for the present as separate species.

The two species differ by the frequent presence of a group of multilocular disc pores behind the front coxae in *P. ficus* (never present in *P. halli*), the frequent occurrence of translucent pores on the hind femora in *P. ficus* (never present in *P. halli*), multilocular disc pores usually extending

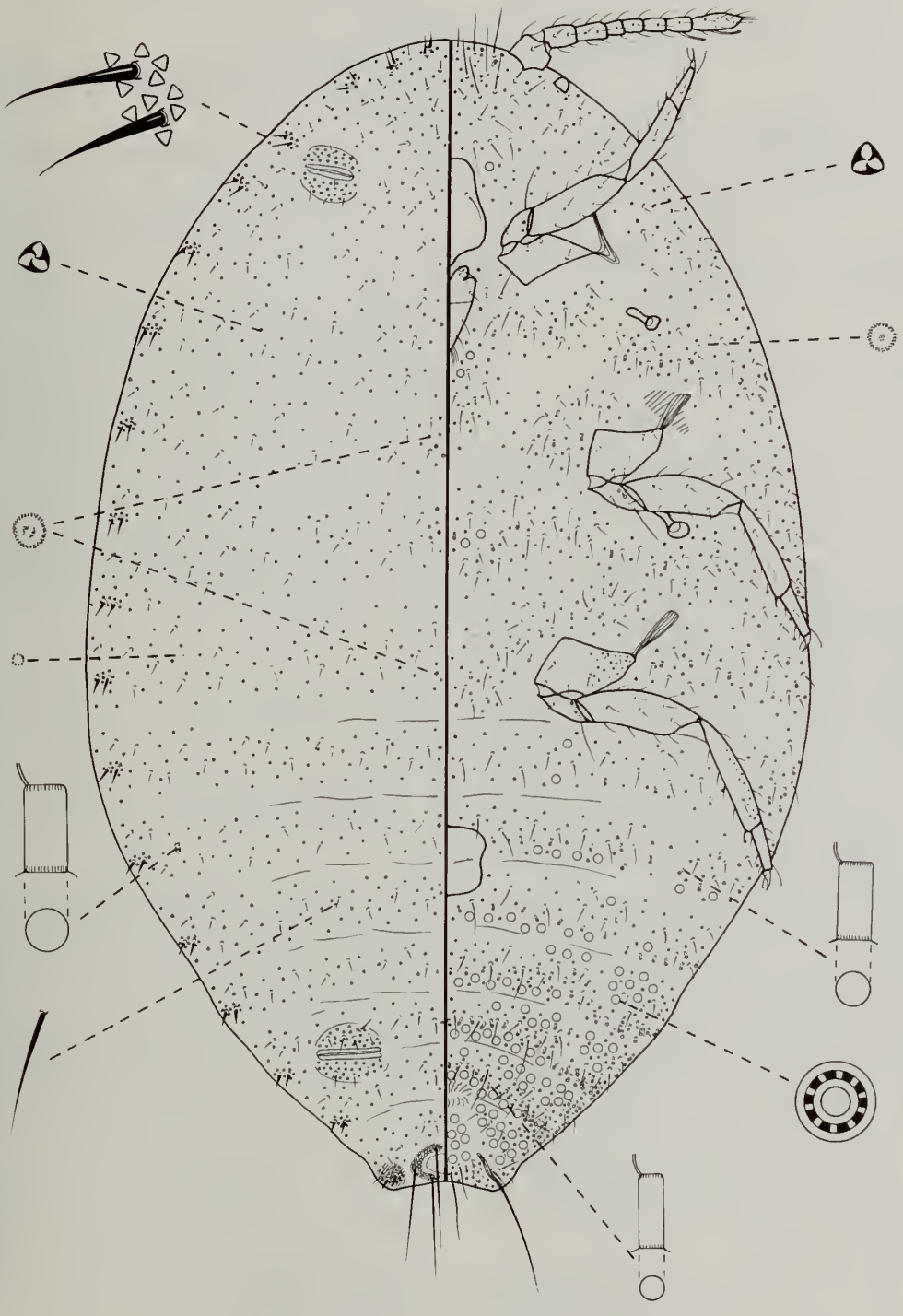

Fig. 14 *Planococcus halli* Ezzat & McConnell.

further forwards on the marginal than on the median areas of the body (the reverse situation usually occurring in *P. halli*), and large simple pores seldom apparent on the midline of the abdominal segments in *P. ficus* (always apparent in *P. halli*).

Specimens from the Sudan and Ethiopia differ from the usual forms of both *P. ficus* and *P. halli*. More work is needed on this complex, preferably carried out locally where live material would be available for experimentation.

Economic status. *P. halli* is frequently intercepted in the U.S.A. and the U.K. on yam tubers from Nigeria and the West Indies.

Planococcus hospitus De Lotto

(Fig. 15)

Planococus hospitus De Lotto, 1961 : 221. Holotype ♀, Uganda: on *Eulophia* (BMNH) [examined].

Adult female. Mounted specimen rotund, length 1.8 mm, width 1.4 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 conical setae which are stout on abdominal segments but more slender on head. Legs stout; hind trochanter + femur 220 μm long, hind tibia + tarsus 200 μm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.91; translucent pores not apparant on hind legs. Inner edges of ostioles well sclerotized. Circulus small and oval, width 65 μm. Cisanal setae shorter than anal lobe setae. Anal lobe cerarii each situated on a small, lightly sclerotized area.

Venter. Multilocular disc pores confined to median areas of abdomen, present around vulva and in single rows across posterior edges of median areas of abdominal segments V or VI. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 1 size, confined to median areas of abdomen, present in single rows across median areas of abdominal segments IV-VII. Simple pores about the same size as the multilocular disc pores, lightly sclerotized, and scattered over entire venter. Setae on median areas long, fine and flagellate, but those on margins moderately long and fine, and with indistinctly knobbed tips.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores numerous and evenly distributed. Simple pores of 2 sizes, pores about twice the size of the trilocular pores scattered over entire dorsum, larger pores in groups on mid-line of thoracic and abdominal segments. Setae moderately long and fine, and with indistinctly knobbed tips; length of longest seta on abdominal segments VI or VII about 30 μm.

Material examined

Holotype ♀, **Uganda**: Kampala, on tubers of *Eulophia* sp., 18.x.1956 (*A. G. P. Michelmore*) (BMNH).

Distribution. Afrotropical Region: Uganda.

Hostplant. Orchidaceae: *Eulophia* sp.

Remarks. This species was originally described from, and is still only known from, a single specimen.

P. hospitus is similar to the other 4 species of *Planococcus* which occur on orchids, *P. hosyni* and *P. orchidi* from the Afrotropical Region, and *P. dendrobii* and *P. philippinensis* from the Oriental Region. All have low numbers of multilocular disc pores and tubular ducts, and have knobbed (although often indistinctly) dorsal setae. *P. hospitus* and *P. hosyni* may be distinguished from the other species by their lack of marginal tubular ducts and from each other by the presence of translucent pores on the hind tibiae and tarsi in *P. hosyni* and by the very large ventral simple pores in *P. hospitus*.

Planococcus hosyni Ezzat & McConnell

(Fig. 16)

Planococcus hosyni Ezzat McConnell, 1956: 83. Holotype ♀, Zimbabwe: on *Aerangis katschii* (USNM) [examined].

Adult female. Mounted specimens oval to rotund, length 1.3–2.1 mm, width 0.8–1.8 mm. Margin of body with a complete series of 18 pairs of cerarii, all with moderately stout conical setae. Legs stout; hind trochanter + femur 180–210 μm long, hind tibia + tarsus 195–210 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.0–1.05; translucent pores present on hind coxae and tibiae. Inner edges of ostioles moderately sclerotized. Circulus small and round, width 47–57 μm. Cisanal setae shorter than anal ring setae. Anal lobes not noticeably sclerotized.

Venter. Multilocular disc pores confined to median areas of abdomen, present around vulva, in a single row across posterior border of median area of abdominal segment VI, and 1–3 pores present on segments IV or V. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 1 size, confined to median areas of abdomen, occurring sparsely in rows across median areas of abdominal segments

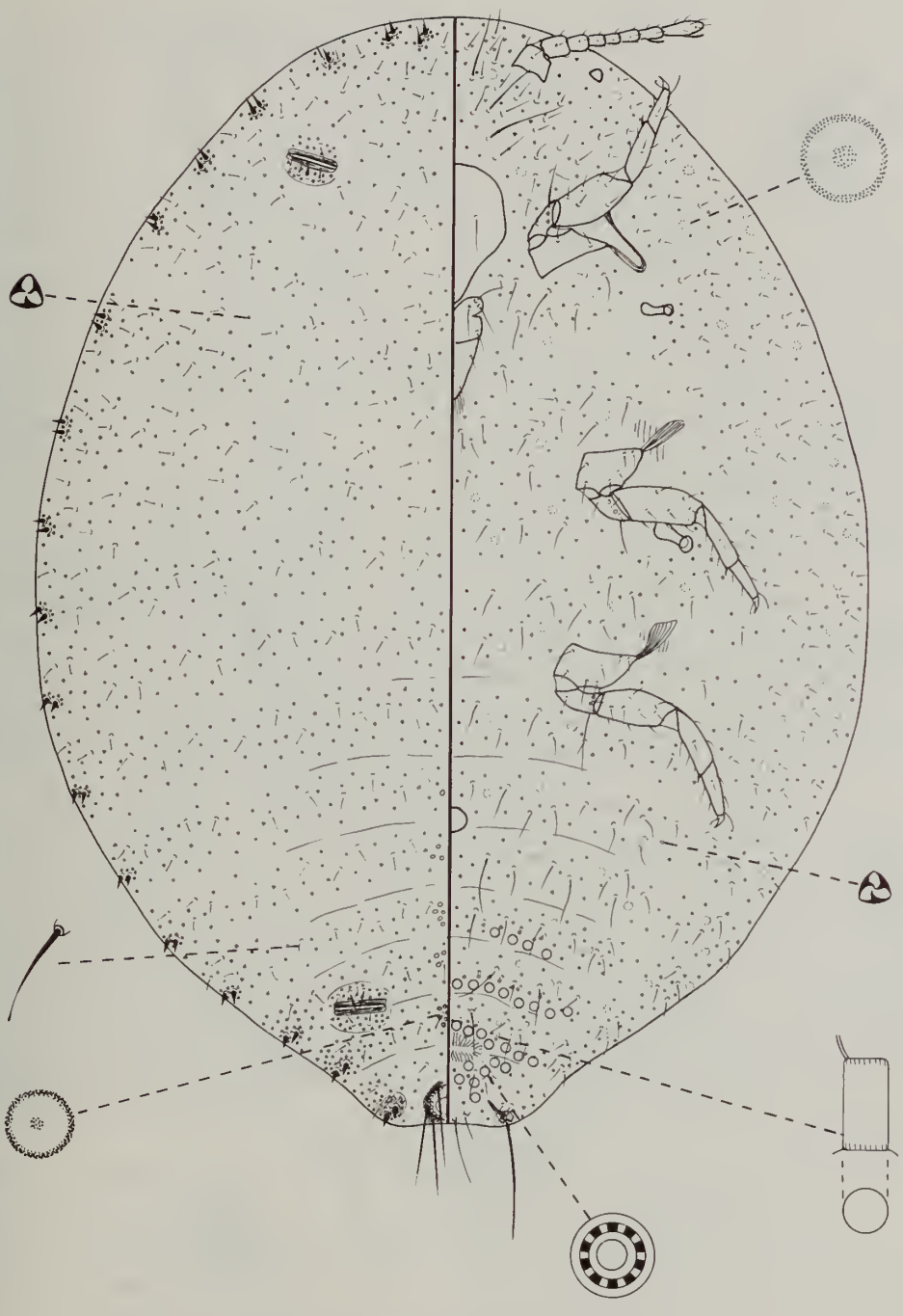

Fig. 15 *Planococcus hospitus* De Lotto.

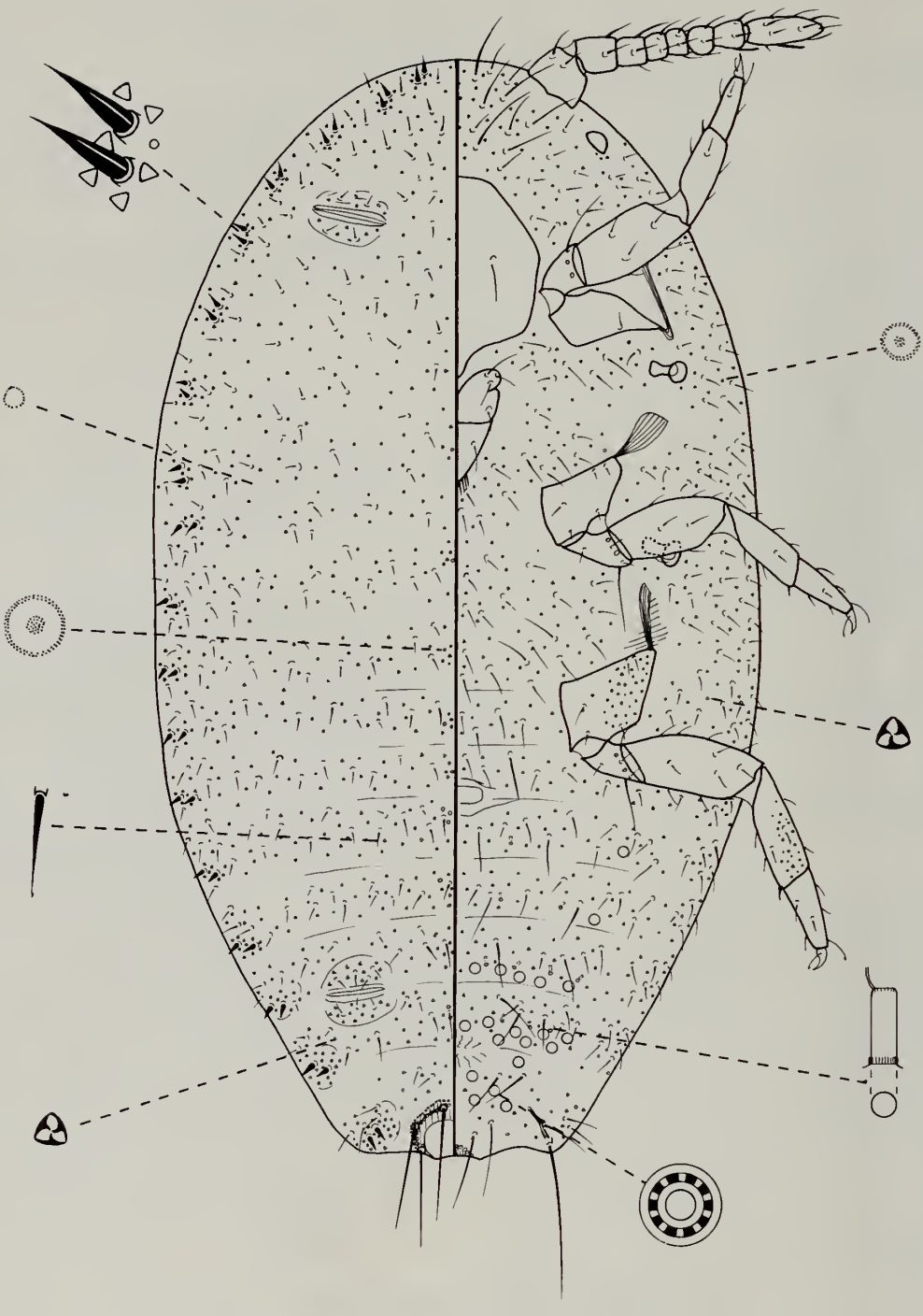

Fig. 16 *Planococcus hosyni* Ezzat & McConnell.

IV-VII. Simple pores about the same size as the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores of 2 sizes, smaller pores smaller than the trilocular pores and sparsely scattered over entire dorsum, larger simple pores slightly larger than the trilocular pores, present in groups on mid-line of thoracic and abdominal segments. Setae moderately long and stout, flagellate but with indistinctly knobbed tips, length of longest seta on abdominal segments VI or VI 23–30 μm.

MATERIAL EXAMINED
5 ♀ (including holotype) (BMNH, USNM).

Holotype ♀, **Zimbabwe** (Rhodesia): on *Aerangis katschii*, 2.vii.1953 (*D. Kamper*) (USNM).

DISTRIBUTION. Afrotropical Region: South Africa, Zimbabwe.

HOSTPLANT. Orchidaceae: *Aerangis katschii*.

REMARKS. This species was originally described from the holotype only. This specimen is a very young adult female – although its body shape is oval, the mature female would probably have been rotund, as in the additional material examined. Other specimens examined from South Africa also on Orchidaceae have the dorsal setae slightly more distinctly knobbed than those of the holotype, but this characteristic can be observed in the latter specimen under high magnification

P. hosyni is most similar to *P. hospitus*, also from the Afrotropical Region, in completely lacking marginal tubular ducts and in having flagellate, yet knobbed, dorsal setae, but can be distinguished by the very large ventral simple pores which are present in *P. hospitus*. The three other known species with knobbed dorsal setae, *P. orchidi* from the Afrotropical Region, and *P. dendrobii* and *P. philippinensis* from the Oriental region, all recorded only from orchids, have marginal tubular ducts on abdominal segments VI or VII and much stouter dorsal setae.

Planococcus japonicus sp. n.

(Fig. 17)

[*Planococcus azaleae* (Tinsley) Ezzat & McConnell, 1956: 63. Misidentification.]

ADULT FEMALE. Mounted specimens oval, length 1.5–3.9 mm, width 0.9–2.3 mm. Margin of body with a complete series of 18 pairs of cerarii, cephalic and thoracic pairs each with 2–5 conical setae and abdominal pairs each with 2 conical setae. Legs elongate, hind femur + trochanter 240–315 μm long, hind tibia + tarsus 275–340 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.03–1.17; translucent pores present on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate, width 80–145 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores situated around vulva, in rows across posterior edges of median areas of abdominal segments III-VII or IV-VII and across anterior edges of segments V-VII, a few pores present on margins of segments VI or VII, up to 7 pores situated on head and 5–16 pores scattered over median areas of thorax. Oral collar tubular ducts of 2 sizes; smaller ducts present in rows across median areas of abdominal segments II-VII; larger ducts present in rows across median areas of segments IV-VI, in marginal groups on segments I-VIII, in a larger marginal group on each side of prothorax and a few ducts sometimes present on head and margins of mesothorax. Trilocular pores evenly distributed. Simple pores minute, scattered over venter.

Dorsum. Multilocular disc pores absent. Some specimens (including the holotype) with 1 or 2 tubular ducts with distinct rims present on the head. Trilocular pores and simple pores as for venter. Setae short and stout, sometimes almost conical or lanceolate, longest seta on abdominal segments VI or VII 15–20 μm long.

MATERIAL EXAMINED
Holotype ♀, **Japan**: Fukuoka, Ryugezi, on *Pyrus* sp., 6.vi.1968 (*Hiroshi Kajita*) (USNM).
Paratypes. **Japan**: 2 ♀, same data as holotype; 1 ♀, (intercepted at Anchorage), on *Eriobotrya japonica* fruit, 8.vi.1971 (*D. Husnik*) (USNM); 1 ♀, (intercepted at Seattle), on *Eriobotrya japonica* fruit, 8.vi.1971 (*R. F. Goodall*) (USNM); 12 ♀, (at National Arboretum, Washington, D.C.), on *Rhododendron indicum* stem, 3.viii.1978 (*S. Nakahara & R. Brittingham*) (BMNH, USNM).

DISTRIBUTION. Palaearctic Region: Japan.

HOSTPLANTS. Ericaceae: *Rhododendron indicum*. Rosaceae: *Eriobotrya japonica, Pyrus* sp.

REMARKS. This species has frequently been confused with *Crisicoccus azaleae* Tinsley, and was redescribed and illustrated as *Planococcus azaleae* by Ezzat & McConnell (1956). The latter species has fewer pairs of cerarii and has much more flagellate dorsal setae than does *P. japonicus* (Fig. 18). Some of the material listed above was labelled as *Crisicoccus matsumotoi* (Shiraiwa), but this species has very long flagellate dorsal

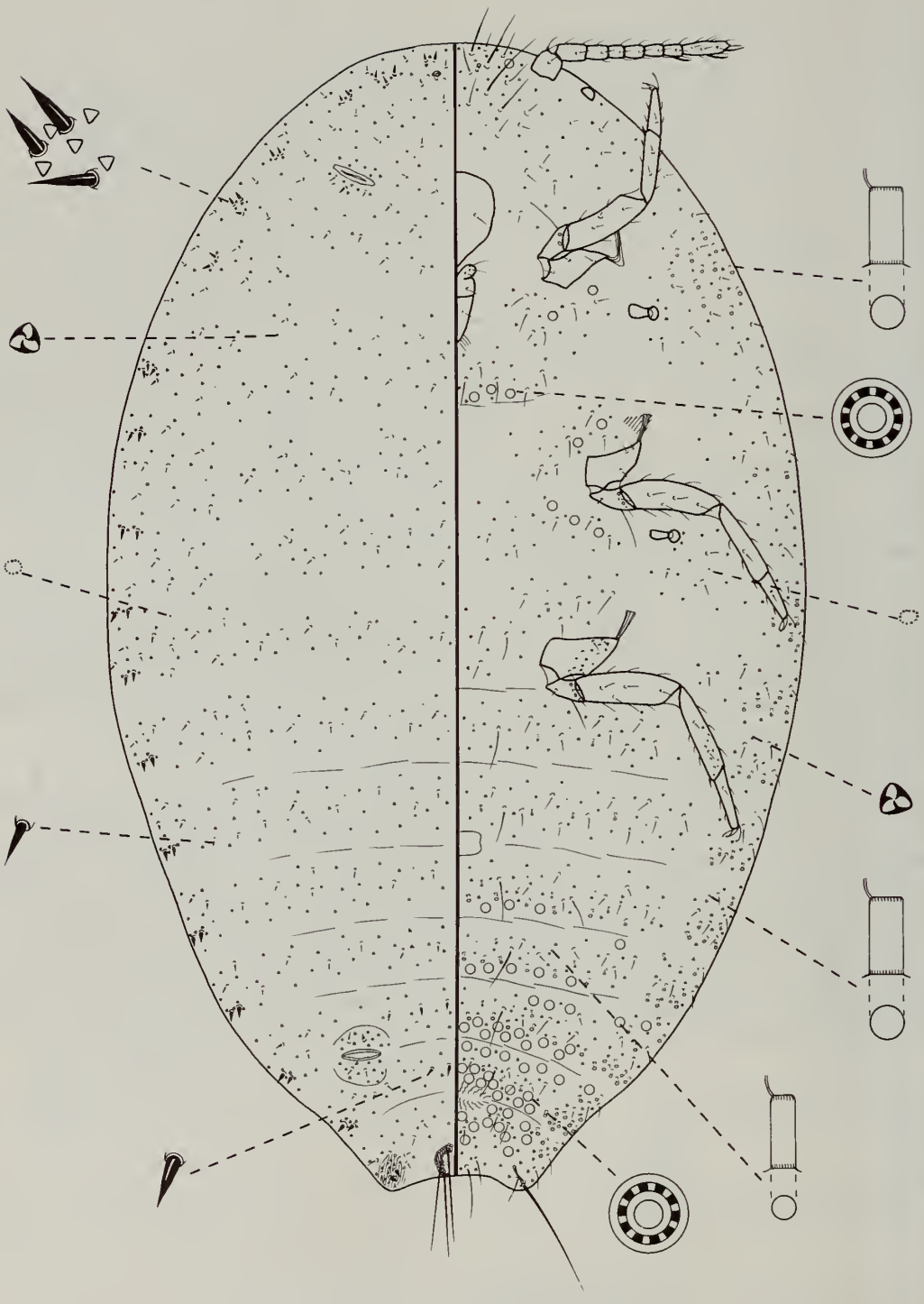

Fig. 17 *Planococcus japonicus* sp. n.

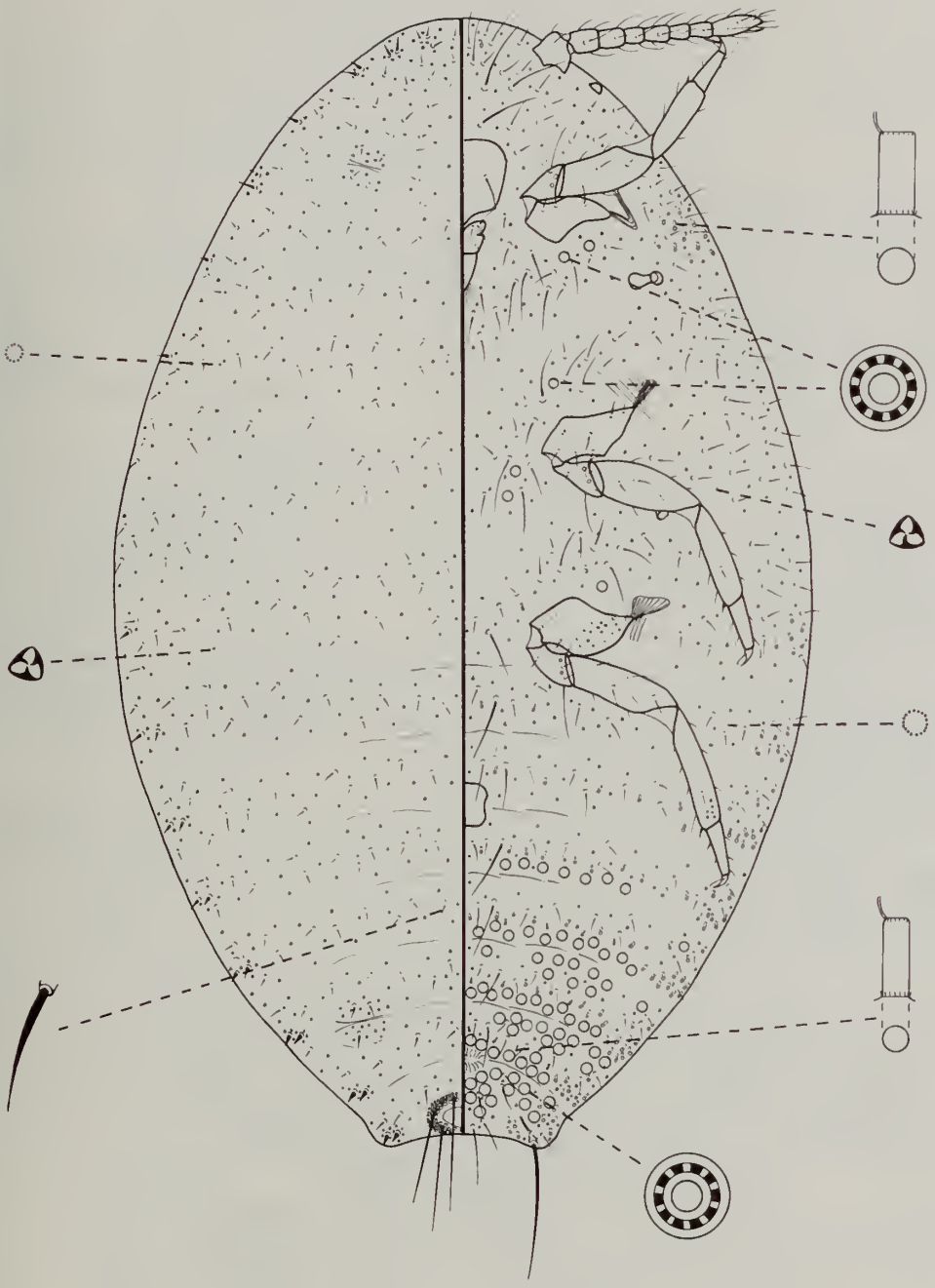

Fig. 18 *Crisicoccus azaleae* (Tinsley)

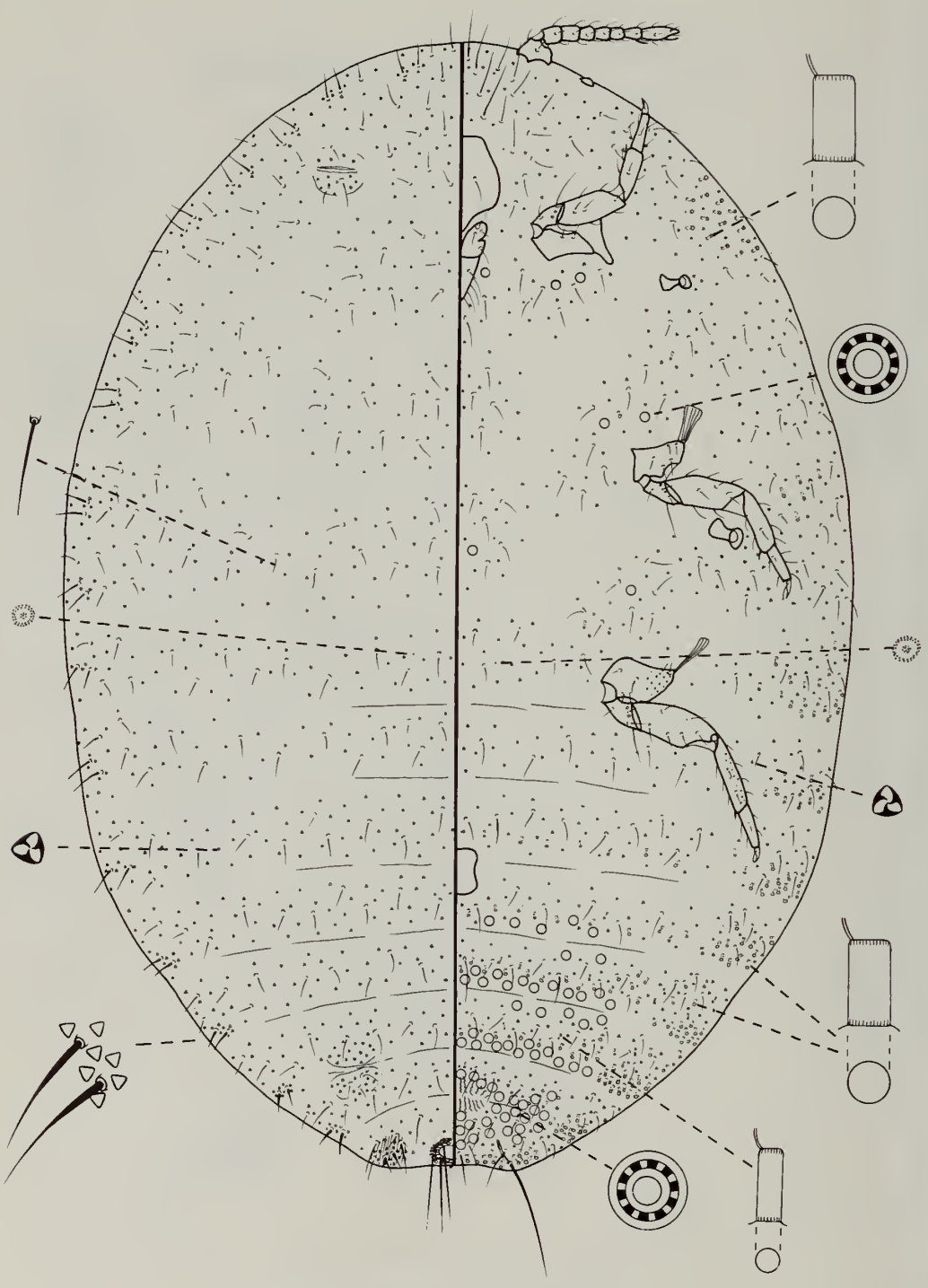

Fig. 19 *Crisicoccus matsumotoi* (Shiraiwa).

setae (Fig. 19). It is quite probable that all three of these species are related, as the distinction of *Crisicoccus* from *Planococcus* is only by the loss of cerarii in the former genus.

P. japonicus is very similar to *P. mali* which, at present, is known only from New Zealand and Australia. It differs from *P. mali* by having smaller legs and a larger group of oral collar tubular ducts on each side of the prothorax. The separation of these two species is discussed in more detail under *P. mali*.

Economic status. This species caused heavy infestations on *Rhododendron* at the National Arboretum, Washington D.C. in 1978.

Planococcus kenyae (Le Pelley)

(Fig. 20)

Pseudococcus citri var. *congoensis* Newstead; Mann, 1922: 629. Nomen nudum.
Pseudococcus kenyae Le Pelley, 1935: 185. Holotype ♀, Kenya: on *Coffea arabica* (BMNH, ?missing) [not examined].
Pseudococcus kenyaensis Betrem 1936: 129. Nomen nudum.
Planococcus kenyae (Le Pelley) Ferris, 1950: 164.
Planococcus subukiaensis De Lotto, 1954: 110. Holotype ♀, Kenya: on *Coffea arabica* (BMNH) [examined]. **Syn. n.**

Adult female. Mounted specimens oval to rotund, length 1.4–2.7 mm, width 0.8–2.0 mm. Margin of body with a complete series of 18 pairs of cerarii, all with moderately stout conical setae. Legs elongate; hind trochanter + femur 225–340 μm long, hind tibia + tarsus 250–355 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.97–1.11; translucent pores present on hind coxae and tibiae. Inner edges of ostioles moderately sclerotized. Circulus quadrate and of moderate size, width 50–160 μm. Cisanal setae usually noticeably longer than anal ring setae. Anal lobe cerarii each situated on a large, pronounced, sclerotized area which is apparent only in well-stained specimens.

Venter. Multilocular disc pores usually confined to median areas of venter, present around vulva and in single rows across posterior borders of median areas of abdominal segments IV-VII, a few pores sometimes present on anterior borders of median areas of abdominal segments VI and/or VII and on margins of segments V-VII. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts occurring sparsely in rows across median areas of abdominal segments VI or VII; larger ducts present in rows across median areas of all abdominal segments, usually sparsely scattered over median areas of thorax, and often present singly or in small marginal groups around entire venter, a single duct often located adjacent to each postocular cerarius. Simple pores about the same size as the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores of 2 sizes, smaller size smaller than the trilocular pores and sparsely scattered over entire dorsum, larger size about twice the size of the trilocular pores in groups on mid-line of abdominal segments I-V. Setae flagellate and moderately short and stout, length of longest seta on abdominal segments VI or VI usually 15–26 μm, rarely up to 40 μm.

Material examined

Over 100 ♀ (including type material listed) (BMNH, MNNH).

Pseudococcus kenyae. Holotype ♀ apparently missing. Paratypes, 8 ♀, **Kenya**: Nairobi, Scott Agri. Lab., on *Coffea arabica*, 1.iii.1935 (*P. B. Notley*); 1 ♀, same data except 23.vi.1933 (BMNH).

Planococcus subukiaensis. Holotype ♀, **Kenya**: Subukia, ex *Coffea arabica*, 8.vii.1933 (no collector) (BMNH). Paratypes, 5 ♀, same data as holotype (BMNH, USNM). The original description of *P. subukiaensis* states that the host plant is unknown, but it is given as *Coffea arabica* on the slide labels and by De Lotto (1964).

Distribution. Afrotropical Region: Central African Republic, Ghana, Kenya, Nigeria, Congo, Sudan, Tanzania, Togo, Uganda, Zaire, Zimbabwe.

Hostplants. Anacardaceae: *Lannea discola*. Costaceae: *Costus* sp. Euphorbiacae: *Croton* sp. Leguminosae: *Inga* sp. Loranthaceae: *Loranthus* sp. Malvaceae: *Hibiscus gossypinus*. Passifloraceae: *Barteria fistulosa*. Rubiaceae: *Coffea* sp. *C. arabica*, *Cuviera angloensis*, *Leptactinia* sp. Sterculiaceae: *Theobroma cacao*.

Remarks. *P. kenyae* is readily recognised by its prominent anal lobes, long cisanal setae, multilocular disc pores largely restricted to the posterior borders of the median areas of the abdominal segments and relatively few marginal tubular ducts. It is superficially similar to *P. lilacinus* in having long cisanal setae and multilocular disc pores absent from the margins of the venter, but it lacks the noticeably stout legs and very long dorsal setae of *P. lilacinus*. It is also

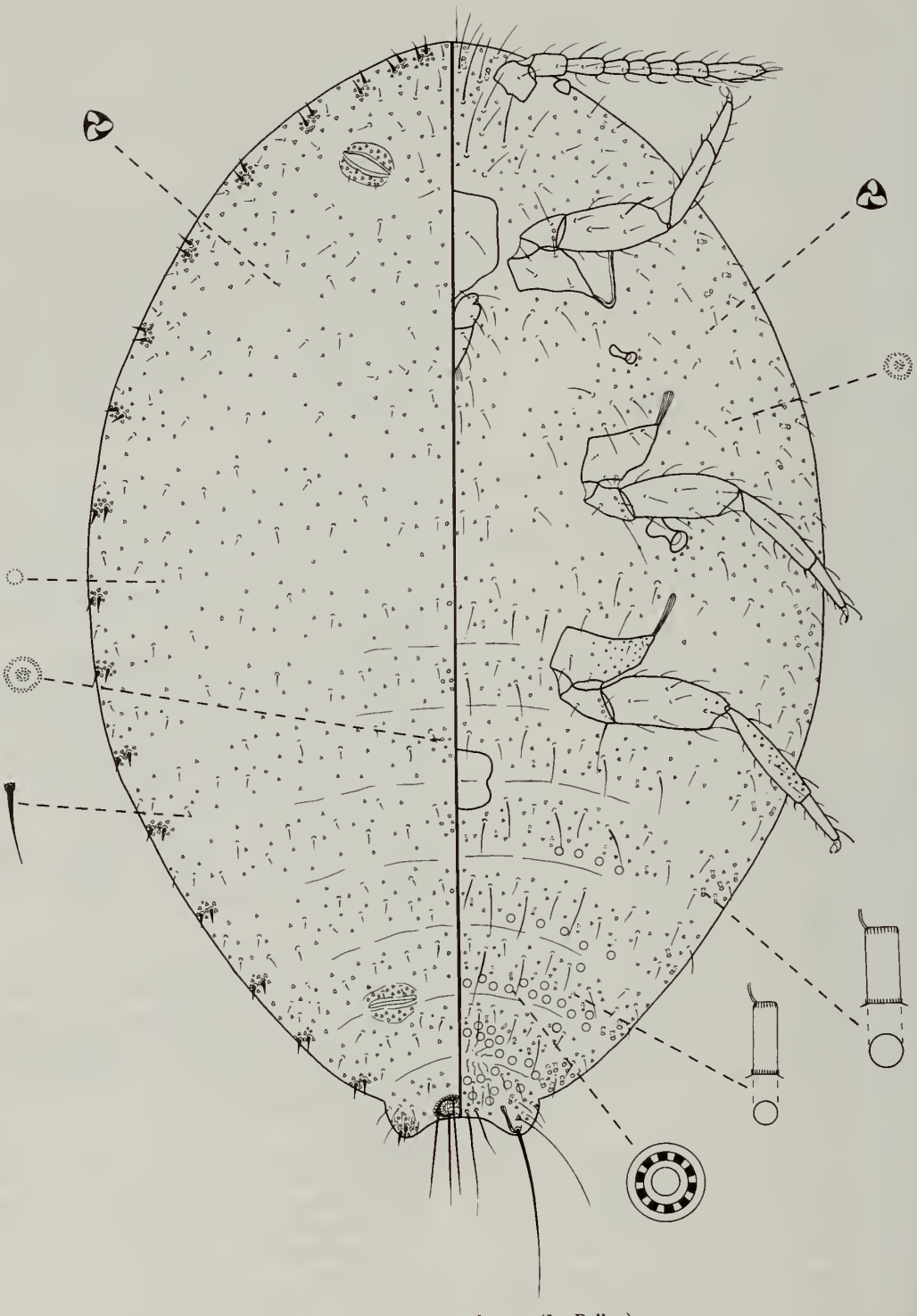

Fig. 20 *Planococcus kenyae* (Le Pelley).

similar to *P. hosnyi* which is known only from the holotype, but differs by having relatively longer cisanal setae, elongate legs, and tubular ducts present on the margins of the body.

P. subukiaensis was described by De Lotto (1954) and redescribed by Ezzat & McConnell (1956) on the basis of a single series of specimens. These were said to differ from *P. kenyae* by lacking the dorsal sclerotized area around the anal lobe cerarii, by having more tubular ducts and multilocular disc pores on the abdomen and by lacking tubular ducts anterior to the circulus. Reexamination of the type-specimens during the course of the present study shows these specimens to have been over-macerated, with the result that the dorsal sclerotization of the dorsal lobes is not apparent. Furthermore there are, in fact, a few tubular ducts present on the margins of the head and thorax in all these specimens. The anal lobe area is somewhat damaged in all the specimens, but in one instance the cisanal seta is clearly elongate as in normal *P. kenyae*. Studied in conjunction with all the material listed below, the type-material of *P. subukiaenis* shows no noticeable deviation from the pattern of variation observed for *P. kenyae*, and the species is consequently here synonomized.

Mann (1922) published the name *Pseudococcus citri* var. *congoensis* Newstead for some ant-attended mealybugs found on *Barteria fistulosa* and *Cuviera angolensis* in the Republic of the Congo. He states that the species was apparently still undescribed, but had been identified by Prof. R. Newstead. Specimens which are undoubtedly those seen by Newstead are in the BMNH and have been identified here as *P. kenyae*.

Economic status. *P. kenyae* is a major pest of coffee in Kenya. The history of its identification highlights one of the common problems encountered in the implementation of biological control programmes. In 1923 a mealybug was found causing considerable damage to coffee in Kenya. As biological control was known to be a sucessful way of controlling coccoids, parasites were sought for its control. The mealybug was initially identified as the citrus mealybug *P. citri* for which parasites were available in California. These were introduced into Kenya and tested against the coffee mealybug, but the results were unsuccessful. The mealybug was then redetermined as *P. lilacinus*, an Oriental species. Parasites were collected from south-east Asia, taken to Africa, and tested against the coffee mealybug, again without success. Finally, 12 years after this mealybug became a problem, it was recognized as being an undescribed species and appropriate parasites found for it in the neighbouring African countries (Le Pelley, 1935; 1943a). It is interesting that the specimens labelled as *Pseudococcus citri* var. *congoensis* by Newstead, discussed above, were collected in 1919. To date, *P. kenyae* is known only from the Afrotropical Region.

Planococcus kraunhiae (Kuwana)

(Fig. 21)

Dactylopius kraunhiae Kuwana, 1902: 55. Syntypes ♀, Japan: on *Wisteria floribunda* (as '*Kraunhia floribunda*') (location of types not known) [not examined].

Pseudococcus kraunhiae (Kuwana) Fernald, 1903: 104.

Planococcus kraunhiae (Kuwana) Ferris, 1950: 158; Ezzat McConnell, 1956: 87; McKenzie, 1967: 283.

Planococcus siakwanensis Borchsenius, 1962: 586. Holotype ♀, China: on undetermined host (ZIL) [not examined]. **Syn. n.**

Adult female. Mounted specimens oval, length 2.0–3.3 mm, width 1.1–2.0 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 slender conical setae, slightly swollen at the base, more slender towards the anterior end of the body. Legs elongate; hind trochanter + femur 285–375 μm long, hind tibia + tarsus 305–430 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.06–1.20; translucent pores present on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus small and quadrate, width 80–190 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, lightly sclerotized area which is apparent only in well-stained specimens.

Venter. Multilocular disc pores present around vulva, in single or double rows across posterior edges of median areas of abdominal segments II-VII, in single rows across anterior edges of segments III-VII or IV-VII, 1–4 pores present on each margin of segments V-VII, and a few pores scattered over thorax. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller size occurring sparsely in rows across median areas of abdominal segments III-VII; larger size in rows across median areas of segments II-VI, sparsely scattered over median areas of thorax and present in small marginal groups on head and thorax and in larger groups on margins of abdominal segments. Simple pores about half the size of the trilocular pores, very sparsely scattered over abdominal segments only.

Dorsum. Multilocular disc pores absent. Trilocular pores moderately numerous and generally

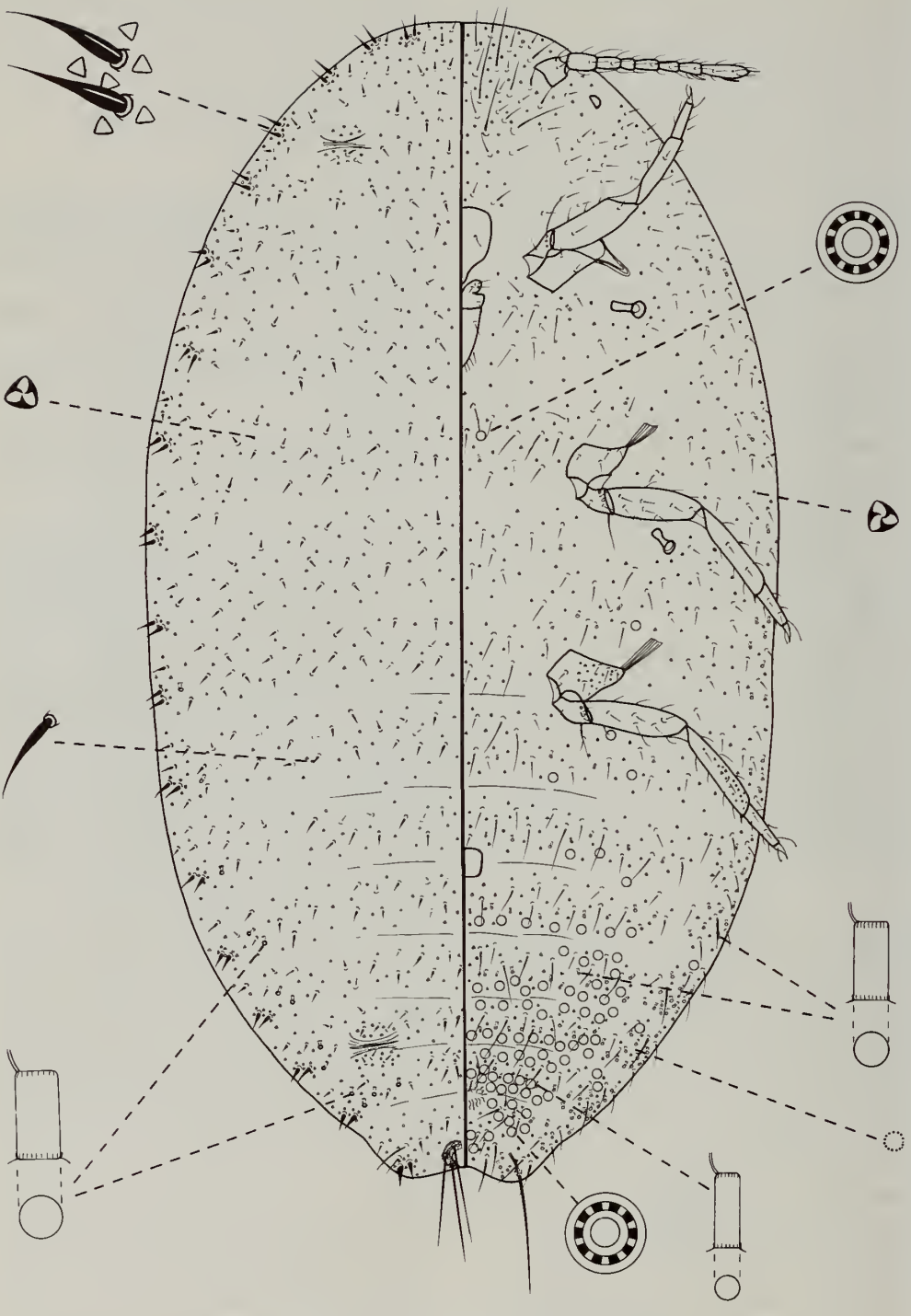

Fig. 21 *Planococcus kraunhiae* (Kuwana).

evenly distributed, but 1 or 2 pores sometimes associated with the bases of some of the larger setae. Tubular ducts, larger than the larger size on the venter and without apparent rims, variable in number, present in groups of 2–5 ducts adjacent to at least some abdominal cerarii, sometimes also sparsely in rows across some abdominal segments. Simple pores apparently absent. Setae with flagellate tips and distinctly swollen bases, length of longest seta on abdominal segments VI or VI 18–26 μm.

MATERIAL EXAMINED

19 ♀ (including type material listed below) (BMNH, ZIL, UCD, USNM).

Planococcus siakwanensis Borchsenius. 1 paratype ♀, **China:** Yunnan Province, nr Siakwan, on branches of an undetermined shrub, 17.iv.1957 (*Borchsenius*) (ZIL).

DISTRIBUTION. Palearctic Region: Korea (intercepted in U.S.A.), Japan. Oriental Region: China. Nearctic Region: U.S.A., California. Frequently intercepted in the U.S.A. on fruit imported from Japan.

HOSTPLANTS. Ebenaceae: *Diospyros kaki*. Leguminosae: *Wisteria* sp. Rutaceae: *Citrus* sp. Also recorded from *Wisteria floribunda* (as '*Kraunhia floribunda*') (Kuwana, 1902), *Ficus carica* (Moraceae), *Plantanus orientalis* (Plantanaceae), *Citrus noblis* var. *unshiu*, *Citrus paradisi* and *Ilex* sp. (Aquifoliaceae) (McKenzie, 1967). Some of these records may be based on misidentifications.

The records by Ezzat & McConnell (1956) on croton (*Croton* sp., Euphorbiaceae) from Jamaica (intercepted in U.S.A.) and *Olea chrysophylla* (Oleaceae) from Eritrea, Ethiopia are regarded here as being dubious. Specimens of the latter record have been located and are a species of *Delottococcus*.

REMARKS. This is apparently an eastern Palaearctic species that has been introduced into the U.S.A.

P. kraunhiae is characterised by having only a few multilocular disc pores on the margins of the abdomen, short, stout dorsal setae with swollen bases and flagellate tips, and groups of 2–5 tubular ducts on the dorsum adjacent to most of the abdominal cerarii. *P. kraunhiae* could be confused with two other species that often have similar numbers and distribution of dorsal tubular ducts, *P. ficus* and *P. vovae*. It differs from *P. ficus* by having considerably fewer multilocular disc pores on the margins of the abdominal segments and by having differently shaped dorsal setae (slender and flagellate in *P. ficus*), and from *P. vovae* by having at least a few multilocular disc pores on the margins of the abdominal segments and by the same difference in the shape of the dorsal setae as in *P. ficus*. The swollen-based dorsal setae may cause it to be confused with the *dorsospinosus*-group, but these species never have marginal multilocular disc pores, and have the trilocular pores much more aggregated around the bases of the dorsal setae.

The paratype of *P. siakwanensis* examined fits within the observed variation of *P. kraunhiae* collected from other parts of the world. The type specimens of *P. siakwanensis* represent the only material of *P. kraunhiae* known from China.

Planococcus lilacinus (Cockerell)

(Fig. 22)

Pseudococcus lilacinus Cockerell, 1905: 128. Syntypes ♀, PHILIPPINES: on cultivated orange (USNM) [8 syntypes examined].

Pseudococcus tayabanus Cockerell, 1905: 129. Syntypes ♀, PHILIPPINES: on cultivated cacao (USNM) [4 syntypes examined]. [Synonymised by Morrison, 1920: 176.]

Dactylopius crotonis Green, 1906: 44. Nomen nudum.

Dactylopius crotonis Green, 1911: 35. [As new species.] Syntypes ♀, SRI LANKA: on *Castilloa elastica* (BMNH) [4 syntypes examined]. [Synonymised by Morrison, 1920: 176].

Pseudococcus crotonis (Green) Sasscer, 1912: 86.

Pseudococcus deceptor Betrem, 1937: 54. JAVA: on coffee roots (status of type material not known). **Syn. n.**

Tylococcus mauritiensis Mamet, 1939: 579. Holotype ♀, MAURITIUS: on fruits of *Eugenia mespiloides* (BMNH: ?missing) [not examined]. [Synonymized by Ezzat & McConnell, 1956: 89.]

Planococcus crotonis (Green) Ferris, 1950: 164.

Planococcus tayabanus (Cockerell) Ferris, 1950: 164.

Planococcus lilacinus (Cockerell) Ferris, 1950: 164.

[*Planococcus citri* (Risso) Ferris, 1954: 52. Misidentification.]

[*Planococcus citri* (Risso) McKenzie, 1967: 281; illustration only. Misidentification.]

ADULT FEMALE. Mounted specimens broadly oval to rotund, length 1.2–3.1 mm, width 0.7–3.0 mm. Margin of body with a complete series of 18 pairs of cerarii, usually all with stout conical setae, occasionally some of those on head with elongate,

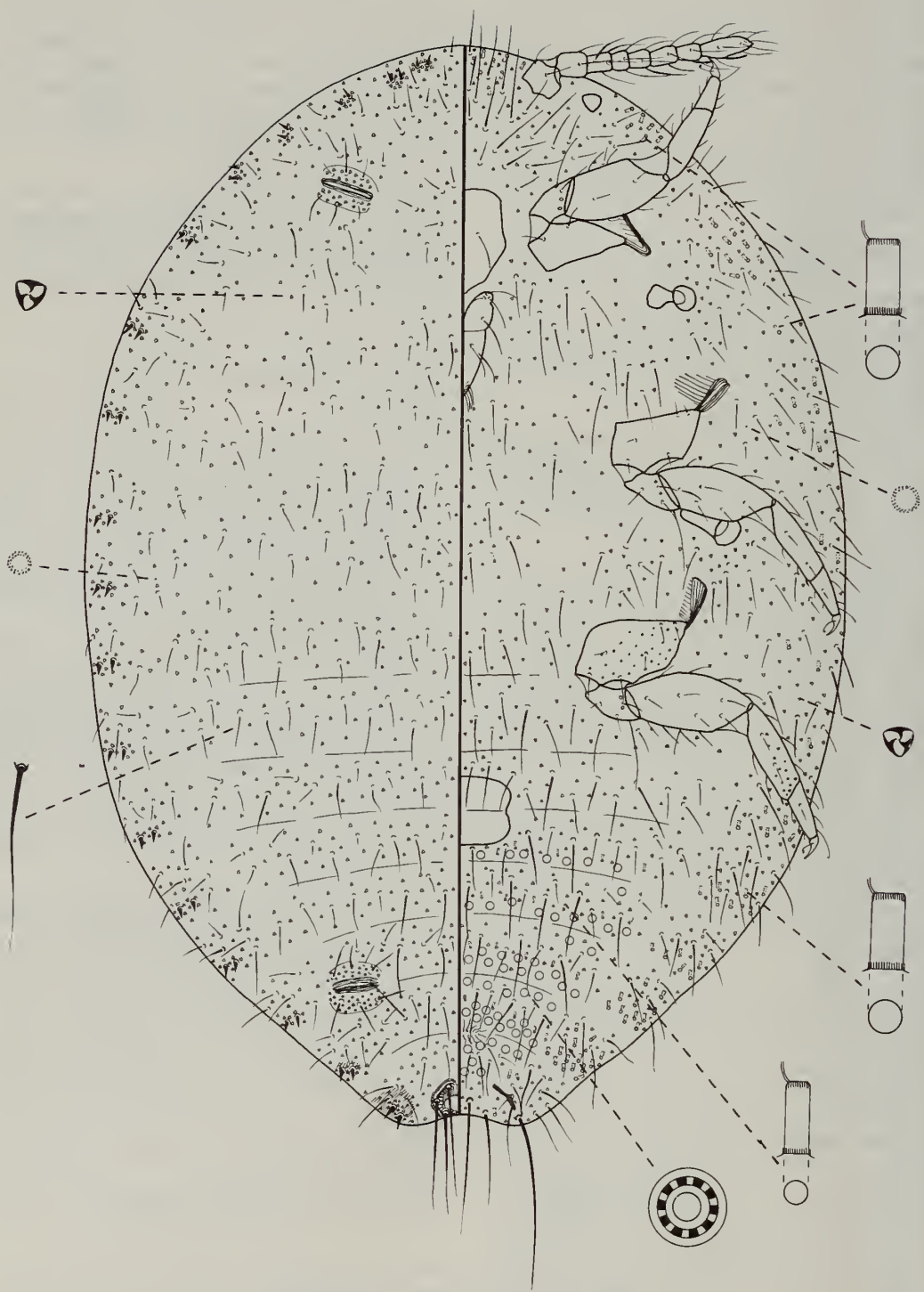

Fig. 22 *Planococcus lilacinus* (Cockerell).

slender setae. Legs stout; hind trochanter + femur 210–315 μm long, hind tibia + tarsus 210–275 μm long, ratios of lengths of hind tibia + tarsus to hind trochanter + femur 0.77–0.97; translucent pores present on hind coxae and tibiae. Inner edges of ostioles strongly sclerotized. Circulus large and quadrate, width 105–200 μm. Cisanal setae noticeably longer than anal ring setae. Anal lobe cerarii each situated on a moderately sized, well-sclerotized area.

Venter. Multilocular disc pores occurring on median areas only, present around vulva, in single or double rows across posterior borders of median areas of abdominal segments IV-VII and usually in a single row across anterior edge of segment VII (although the latter is sometimes reduced to a few pores), and a few pores sometimes present on anterior edges of median areas of abdominal segments V and VI. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts occurring sparsely in rows across median areas of abdominal segments III-VII; larger ducts sparsely scattered over median areas of thorax and present in marginal groups around entire venter, a few ducts also present adjacent to each postocular cerarius. Simple pores about the same size as the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores smaller than the trilocular pores, sparsely but evenly distributed. Setae very long, stout and flagellate, length of longest seta on abdominal segments VI or VII 50–140 μm.

Material examined

About 200 ♀ (including type material listed below) (BMNH, USNM).

Pseudococcus lilacinus Cockerell. 8 syntype ♀, **Philippines:** Lucan, Tayabas, on orange (cult.), 10.iv.1904 (*Townsend*) (USNM).

Pseudococcus tayabanus Cockerell. 4 syntype ♀, **Philippines:** Lucban, Tay[abas], 7 20.iv.1904 (*Townsend*) (USNM).

Tylococcus mauritiensis Mamet. 8 paratype ♀, **Mauritius:** Corpes de Garde Mt, on *Eugenia mespiloides*, 30.i.1938 (*R. Mamet*) (BMNH).

Pseudococcus crotonis Green, 4 syntype ♀, **Sri Lanka (Ceylon):** Gammaduwa, on *Castilloa* [= *Castilla*] *elastica* (*E. E. Green*) (BMNH).

Distribution. Palaearctic Region: Aden. Malagasian Region: Madagascar, Mauritius, Seychelles. Oriental Region: Bangladesh, Burma, China, Formosa, India, Sri Lanka, Vietnam. Austro-oriental Region: Borneo, Indonesia, West Malayasia, Papua New Guinea, Philippines, Java, Cocos Keeling Island. Neotropical Region: Guyana.

Hostplants. Anacardaceae: *Mangifera indica*. Annonaneae: *Annona* sp., *Cananga odorata*. Asteraceae: *Adenophyllum* sp. Bombaceae: *Ochroma* sp. Dioscoreaceae: *Dioscorea* sp. Dipterocarpaceae: *Dipterocarpus* sp. Ehretiaceae: *Cordia myxa*. Euphorbiaceae: *Codiaeum* sp., *Euphorbia pyrifolia, Mallotus japonicus*. *Iridaceae: Gladiolus carmels*. Lecythidaceae: *Couroupita guianensis*. Leguminosae: *Albizia lebbeck, Arachis hypogea, Bauhinia monandra, Cajanus* sp., *Erythrina lithosperma, E. variegata, Hymenaea* sp., *Prosopsis juliflora, Tamarindus indica*. Moraceae: *Castilloa elastica, Ficus rubra*. Myrtaceae: *Eugenia mespiloides, Psidium guava*. Palmae: *Cocos nucifera, Phoenix dactylifera*. Pandaceae: *Pandanus* sp. Puniaceae: *Punica granatum*. Rhamnaceae: *Alphitonia incana, Zizyphus jujuba*. Rubiaceae: *Coffea canephora, C. sepahijala*. Rutaceae: *Citrus aurantium, C. grandis*. Sapindaceae: *Litchi* sp. Simaroubaceae: *Ailanthus* sp. Solanaceae: *Nicotiana tabacum*. Sterculiaceae: *Theobroma cacao*. Umbelliferae: *Apium graveolens*. Verbenaceae: *Tectona grandis*. Vitidaceae: *Vitis vinifera*.

Remarks. The combination of stout legs, long dorsal setae and reduced numbers of multilocular disc pores distinguishes this species from the other known species of *Planococcus*. Some variation occurs in the thickness of the anterior cerarian setae; usually these are moderately stout and conical, but some specimens, notably those from Aden, have some of these setae long and flagellate.

Avasti & Shafee (1987: 38) described a new species, *Planococcus indicus*, from India on a wild plant. Although no type material has been examined, from the original description and illustration it seems likely that *P. indicus* is conspecific with *P. lilacinus*.

In the 1920s and 1930s the African species *P. kenyae* was frequently misidentified as *P. lilacinus*, but the latter is not, as yet, known from this continent. The phylogenetic relationships of *P. lilacinus* are obscure; it does not seem to fit into any of the species-groups into which *Planococcus* has been divided here.

Economic status. *P. lilacinus* is a pest of cocoa throughout the Oriental Region and also occurs on a wide variety of economically important crops such as *Citrus*, guava, coffee, custard apple and mango. Le Pelley (1943b) discusses the hostplants, biology and natural enemies of this species in some detail.

Planococcus litchi sp. n.

(Fig. 23)

Adult female. Mounted specimens oval, length 1.3–2.7 mm, width 0.7–2.0 mm. Margin of body with a complete series of 18 distinct pairs of cerarii, each cerarius with 2 conical setae except for the preocular and postocular cerarii each with 1–3 setae, all cerarian setae elongate-conical and with flagellate tips. Legs elongate; hind trochanter + femur 240–325 μm long, hind tibia tarsus 270–345 μm long; ratios of lengths of hind tibia + tarsus to hind trochanter + femur 1.07–1.16; translucent pores visible on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate and of moderate size, width 95–165 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores confined to median areas of body, present around vulva, in single rows (sometimes double on segment VII in larger specimens) across posterior edges of abdominal segments III-VII (sometimes 1 or 2 pores also on segment II) and anterior edge of abdominal segment VII (sometimes 1–4 pores also present on anterior border of segment VI and occasionally a single pore present on anterior border of segment V); a few pores scattered over thorax. Trilocular pores somewhat sparse. Oral collar tubular ducts of 2 sizes; smaller size present in rows across median areas of abdominal segments VI or VII; larger size present in rows across abdominal segments III-V, scattered over median areas of thorax and occurring in groups around entire venter, but usually absent, or at most 1 duct adjacent to each postocular cerarius. Simple pores about half the size of the trilocular pores, sparsely scattered over entire venter.

Dorsum. Multilocular disc pores absent. Trilocular pores moderately numerous and aggregated around bases of enlarged setae. Tubular ducts, larger than the larger ducts on the venter and without apparent rims, sometimes present singly next to some abdominal cerarii and submedially on some abdominal and thoracic segments, up to 11 ducts present, but frequently absent. Simple pores as for venter but very sparse. Dorsal setae of various sizes, larger setae elongate-conical and with flagellate apices, about the same size as the cerarian setae and each with 2–4 trilocular pores associated with their bases giving the appearance of dorsal cerarii, these enlarged setae present on all body segments except the last abdominal segment; several enlarged setae associated in pairs, submedially and medially on the thorax, and medially on adbominal segment VII; length of longest seta on abdominal segments VI or VII 25–30 μm.

Material examined

Holotype ♀, **Hong Kong** (intercepted at Heathrow, U.K.): on lychees, 1980 (no collector) (BMNH).

Paratypes. **Japan** (intercepted in Hawaii): 1 ♀, on fruit of *Litchi* sp., 17.v.1959 (*R. O. Parsons*) (USNM). **Philippines** (intercepted at San Francisco): 6 ♀, on *Litchi chinensis* fruit, 26.v.1972 (*E. Roberts*) (USNM). **Thailand:** 1 ♀ (intercepted in U.S.A.), on *Litchi* sp. (fruit), 29.vi.1980 (*L. Roberson*) (USNM); 2 ♀ (intercepted in England), on lychees, 1984 (BMNH); 1 ♀ (intercepted in U.S.A.), on *Eriobotrya japonica* (fruit), 6.viii.1982 (*B. Stephenson*) (USNM). **Hong Kong:** 10 ♀ (intercepted at Seattle), on *Litchi* sp. (fruit), 30.v.1976 (*C. R. Payne*) (USNM); 1 ♀ (intercepted at Seattle), on *Litchi chinensis* (fruit), 22.viii.1974 (*R. F. Goodall, M. Harris*) (USNM); 1 ♀ (intercepted?), on litchi, 10.viii.1961 (*R. T. Mitsude*) (USNM). China (intercepted at Seattle): 3 ♀, on litchi (twigs and fruit), 22.v.1960 (*H. C. Nelson*) (USNM).

Distribution. Palaearctic Region: Japan. Oriental Region: China, Hongkong, Thailand. Austro-oriental Region: Philippines. All of these records are based on interceptions in either the U.K. or the U.S.A.

Hostplants. Rosaceae: *Eriobotrya japonica*. Sapindaceae: *Litchi chinensis*. Most commonly found on lychees.

Remarks. The enlarged dorsal setae with trilocular pores aggregated around their bases indicate that this species is a member of the *P. dorsospinosus*-group. It may be distinguished from the other 2 known species of this group, *P. dioscoreae* and *P. dorsospinosus*, by the larger size and grouping of the enlarged dorsal setae into several pairs.

Economic status. *P. litchi* is frequently intercepted on lychee fruit imported into the U.S.A. and the U.K.

Planococcus mali Ezzat & McConnell

(Fig. 24)

Planococcus mali Ezzat & McConnell, 1956: 93; Williams, 1985: 274; Cox, 1987: 75. Holotype ♀, New Zealand (intercepted in U.S.A.): on *Olearia chathamica* (USNM) [examined].

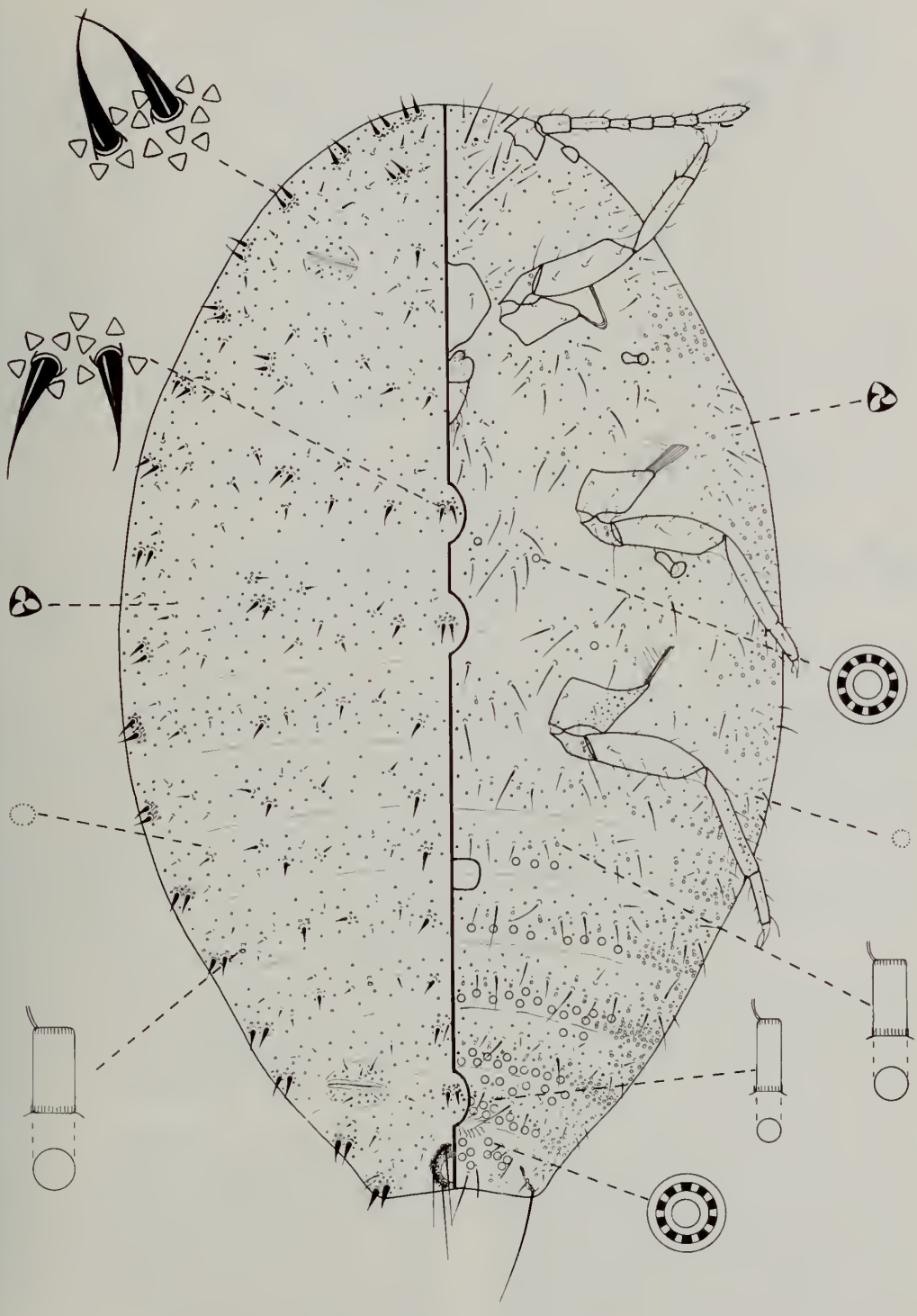

Fig. 23 *Planococcus litchi* sp. n.

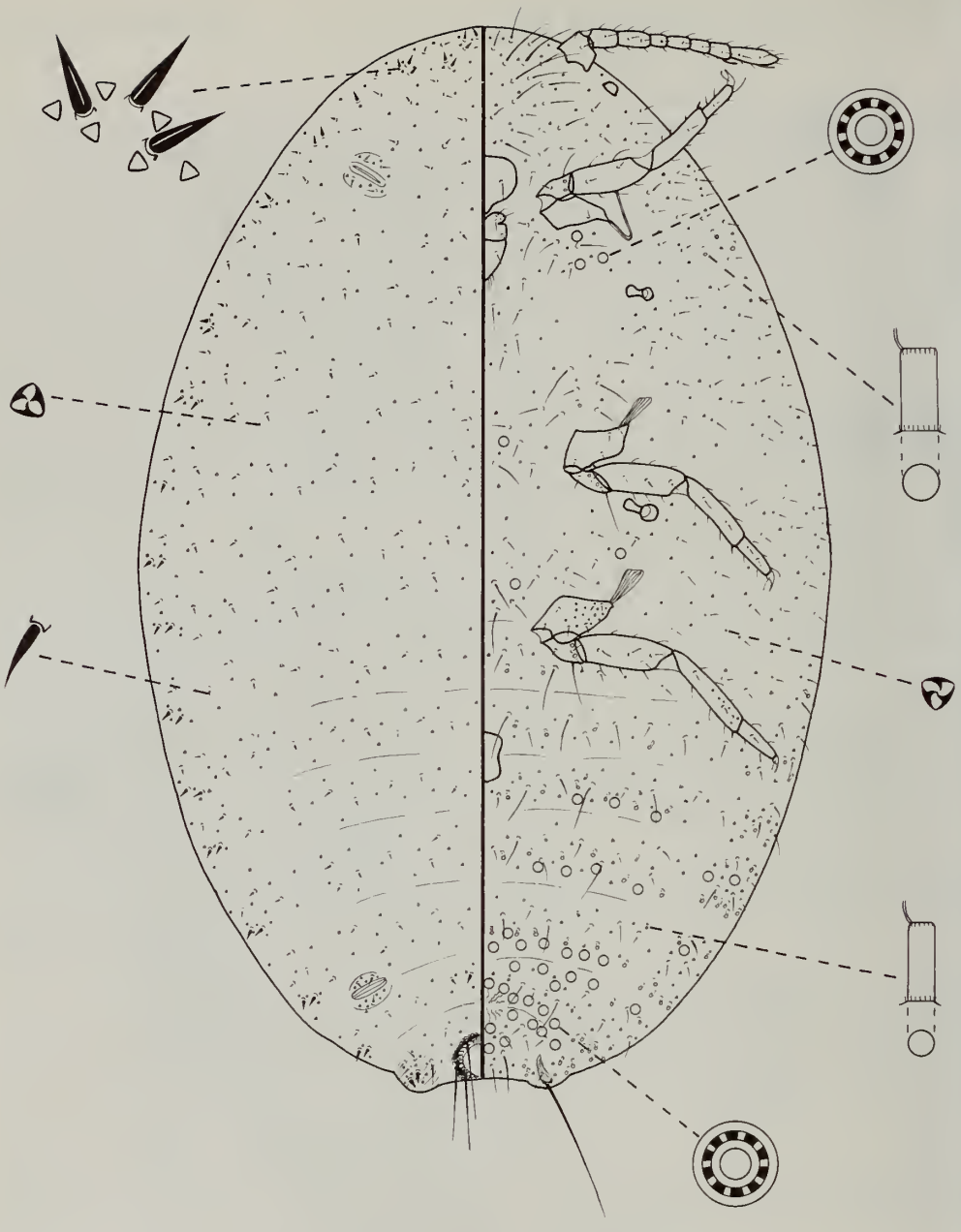

Fig. 24 *Planococcus mali* Ezzat & McConnell.

ADULT FEMALE. Mounted specimens oval, length 2.3–3.3 mm, width 1.2–2.0 mm. Margin of body usually with a complete series of 18 pairs of cerarii, although some pairs are often indistinct or even absent, cephalic and thoracic pairs each with 2–5 conical setae and abdominal pairs each with 2 conical setae. Legs elongate, hind femur + trochanter 275–380 μm long, hind tibia + tarsus 305–410 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.03–1.17; translucent pores present on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate, width 80–190 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sized, moderately sclerotized area.

Venter. Multilocular disc pores situated around vulva, in rows across posterior edges of median

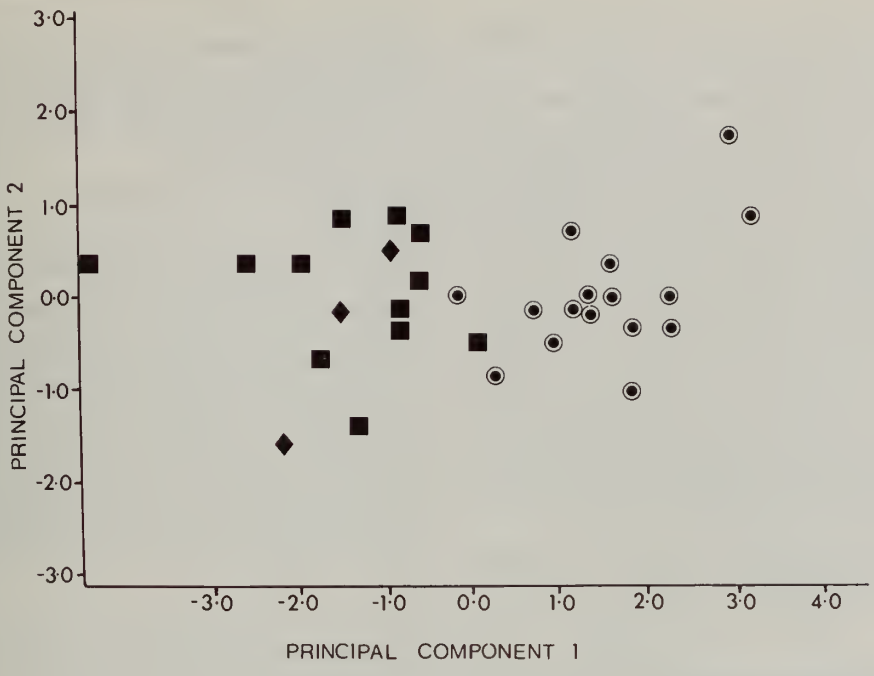

Fig. 25 Plot of first against second principal components of material of *japonicus/mali* from different countries. Squares, New Zealand; diamonds, Australia; circles, Japan.

areas of abdominal segments III-VII or IV-VII and across anterior edges of segments V-VII or VI VII, a few pores present on margins of segments V-VII or VI or VII, a single pore sometimes situated on head, 0–22 pores scattered over median areas of thorax, and in larger specimens, up to 7 pores present amongst the tubular ducts grouped on each side of the prothorax. Trilocular pores evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts in rows across median areas of abdominal segments II-VII; larger ducts in rows across median areas of segments IV-VI, in marginal groups on segments I-VIII, sometimes in a marginal group on each side of prothorax, and sometimes present in small numbers on head and margins of mesothorax. Simple pores not apparent.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores and simple pores as for venter. Setae short and stout, sometimes almost conical, longest seta on abdominal segments VI or VII 15–20 μm long.

MATERIAL EXAMINED

20 ♀ (including type material listed below) (BMNH, NZAC, USNM).

Holotype ♀, **New Zealand** (intercepted at Honolulu): on *Olearia chathamica*, 21.ix.1937 (USNM). Paratypes, 1 ♀, same data as holotype. **Australia:** 1 ♀, Tasmania (intercepted at Buffalo, New York), on *Pyrus malus* [*Malus pumila*], 26.vi.1946 (*Inman Reeges*); 1 ♀, same locality and host (intercepted at Boston, Massachusetts), 27.vi.1946 (USNM).

DISTRIBUTION. Australian Region: Tasmania. New Zealand Region: New Zealand. Also recorded by Williams (1985) from New South Wales.

HOSTPLANTS. Asteraceae: *Olearia chathamica.* Grossulariaceae: *Ribes nigrum*. Labiatae: *Phlomis* sp. Leguminosae: *Acacia* sp. *A. verheillata, Ulex* sp. Pittosporaceae: *Pittosporum* sp. Primulariaceae: *Primula* sp. Rosaceae: *Cotoneaster* sp., *Malus pumila.* Also recorded by Williams (1985) from *Acacia longifolia* and *Psoralea pinnata* (Leguminosae), and *Callitris tasmanica* (Cupressaceae).

REMARKS. *P. mali* is so similar to *P. japonicus* that a principal components analysis was carried out to confirm their distinction (Fig. 25). The two species differ primarily by the fewer tubular ducts in the prothoracic groups and larger legs of *P. mali.* This species is very variable, however, and large specimens may also have large groups of ducts on

the prothorax. These specimens usually also have multilocular disc pores in these groups, a feature never found in *P. japonicus*.

It seems unlikely that sister-species should occur in Japan and New Zealand/Australia respectively. A possible explanation for this is that *P. mali* has been introduced into New Zealand and Australia from somewhere in the vicinity of Japan. This theory is supported by its host preferences in New Zealand and Australia; it occurs most commonly on introduced northern-temperate plants such as *Ribes* and *Malus*, and is, in fact, a pest of blackcurrant in New Zealand. Extensive collecting in Japan may reveal a complex of species. The lack of records of this species from Japan, if it does indeed occur there, might seem surprising at first, but it is possible that this species has been misidentified as *Crisicoccus azaleae*. This is discussed further under *P. japonicus*.

Economic status. *P. mali* is a pest of blackcurrants in New Zealand.

Planococcus martini sp. n.

(Fig. 26)

Adult female. Mounted specimens broadly oval to rotund, length 1.9–2.8 mm, width 1.4–2.1 mm. Margin of body with a complete series of 18 distinct pairs of cerarii, each cerarius with 2 conical setae. Antennae 7-segmented. Legs somewhat stout; hind trochanter + femur 200–230 μm long, hind tibia + tarsus 185–220 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.91–0.96; translucent pores present on hind coxae and a few barely apparent on hind tibiae. Inner edges of ostioles barely sclerotized. Circulus oval, width 70–105 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a fairly prominent sclerotized area.

Venter. Multilocular disc pores confined to median areas, present around vulva and in single rows across posterior edges of abdominal segments V or VI, sometimes also IV. Trilocular pores somewhat sparse. Oral collar tubular ducts of one size, present in rows across median areas of abdominal segments VI or VII, usually also V. Simple pores about the same size as the trilocular pores, sparsely scattered over entire venter.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores moderately numerous and evenly distributed. Simple pores about half the size of the trilocular pores, sparsely scattered over dorsum. Setae short and stout, length of longest seta on abdominal segments VI or VII 16–25 μm.

Material examined

Holotype ♀, **Indonesia:** Sulawesi Utara, nr Base Camp Toraut, roots of Araceae, ?Epipremnum sp., 5.iii.1985 (*J. H. Martin*) (BMNH).

Paratypes. 19 ♀, same data as holotype (BMNH, USNM).

Distribution. Austro-oriental Region: Indonesia.

Hostplants. Araceae: ?*Epipremnum* sp.

Remarks. This species is most similar to the *dendrobii*-group by virtue of its rotund body and in having the multilocular disc pores and oral collar tubular ducts confined to the abdomen. It differs from this group by having 7-segmented antennae and by lacking knobbed dorsal setae, and from the similar *P. zairensis* by having groups of tubular ducts present on, but multilocular disc pores absent from, the margins of abdominal segments VI VII.

Planococcus minor (Maskell) nom. rev., stat. n., comb. n.

(Fig. 27)

Pseudococcus calceolariae var. *minor* Maskell, 1897: 322. Lectotype ♀, Mauritius: on roots of 'onion grass' (NZAC) here designated [examined].

Planococcus pacificus Cox, 1981: 48. Holotype ♀, Western Samoa (intercepted in quarantine, Auckland, New Zealand): on croton leaves (BMNH) [examined]. **Syn. n.**

Adult female. Mounted specimens oval, length 1.3–3.2 mm, width 0.8–1.9 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 conical setae, except for preocular cerarii each of which may have 1 or 3 setae. Legs elongate; hind trochanter + femur 220–360 μm long, hind tibia + tarsus 270–360 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.05–1.15; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles moderately sclerotized. Circulus quadrate, width 85–160 μm. Cisanal setae usually shorter than anal ring setae, occasionally longer. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores present around vulva, in double rows across posterior edges of abdominal segments III-VII (except in very small specimens, hind tibia tarsus less than 250 μm, where these rows may be single), in single rows across anterior edges of segments V-VII or VI-VII, in small groups on margins of abdominal

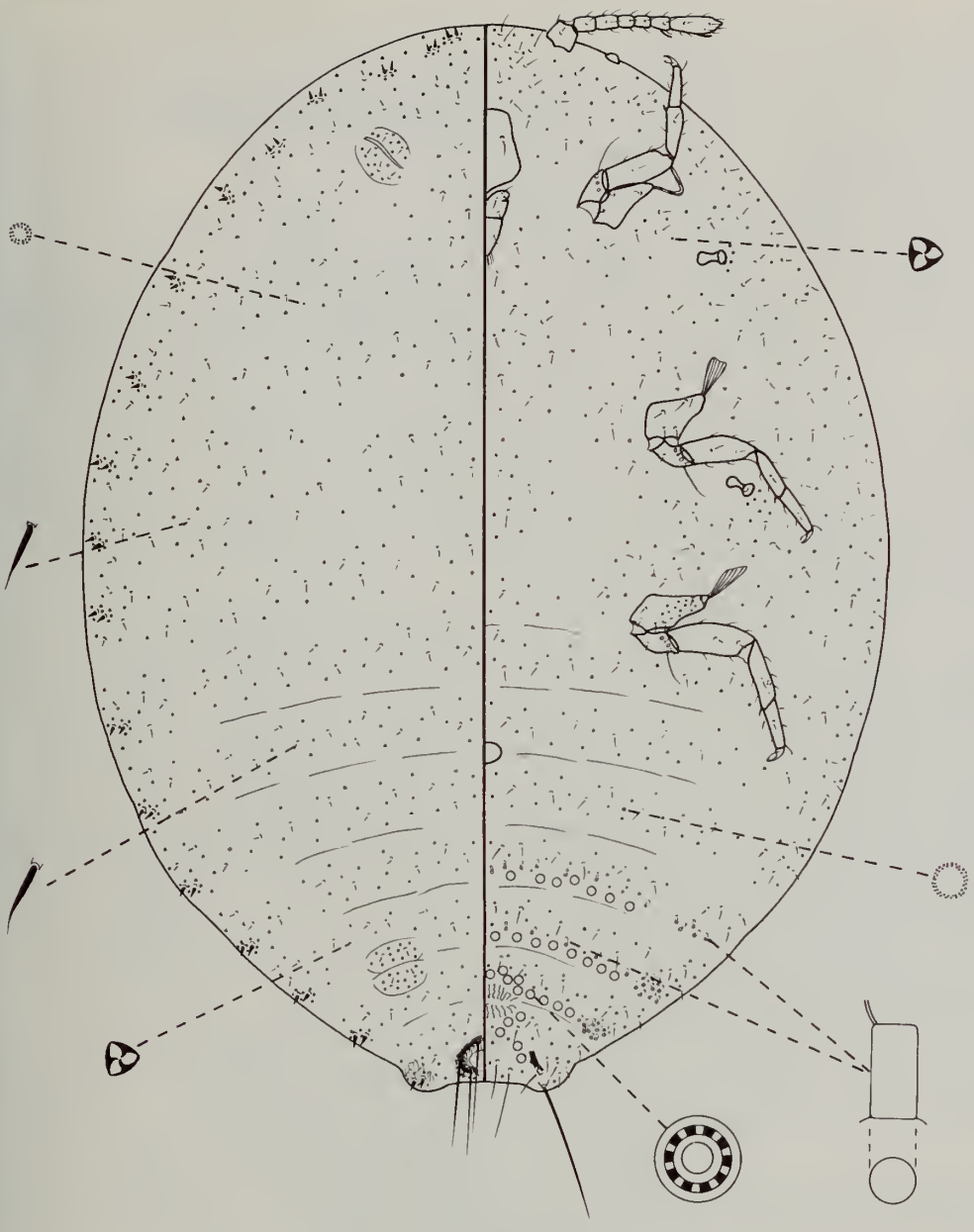

Fig. 26 *Planococcus martini* sp. n.

segments IV-VII, sometimes a few pores scattered over median area of the thorax and head, and frequently several pores present behind each front coxa. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments III-VII; larger ducts present in marginal groups on abdominal segments, often present in small numbers on margins of head and thoracic segments (see Table 1), and scattered over median area of thorax. Simple pores about the same size as the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores absent. Tubular ducts, without apparent rims and slightly larger than the larger size on the venter, sometimes present adjacent to some cerarii, 1 or 2 ducts occasionally present on median areas. Trilocular pores as for venter. Simple pores of 2 sizes, smaller pores smaller than those on venter, scattered over

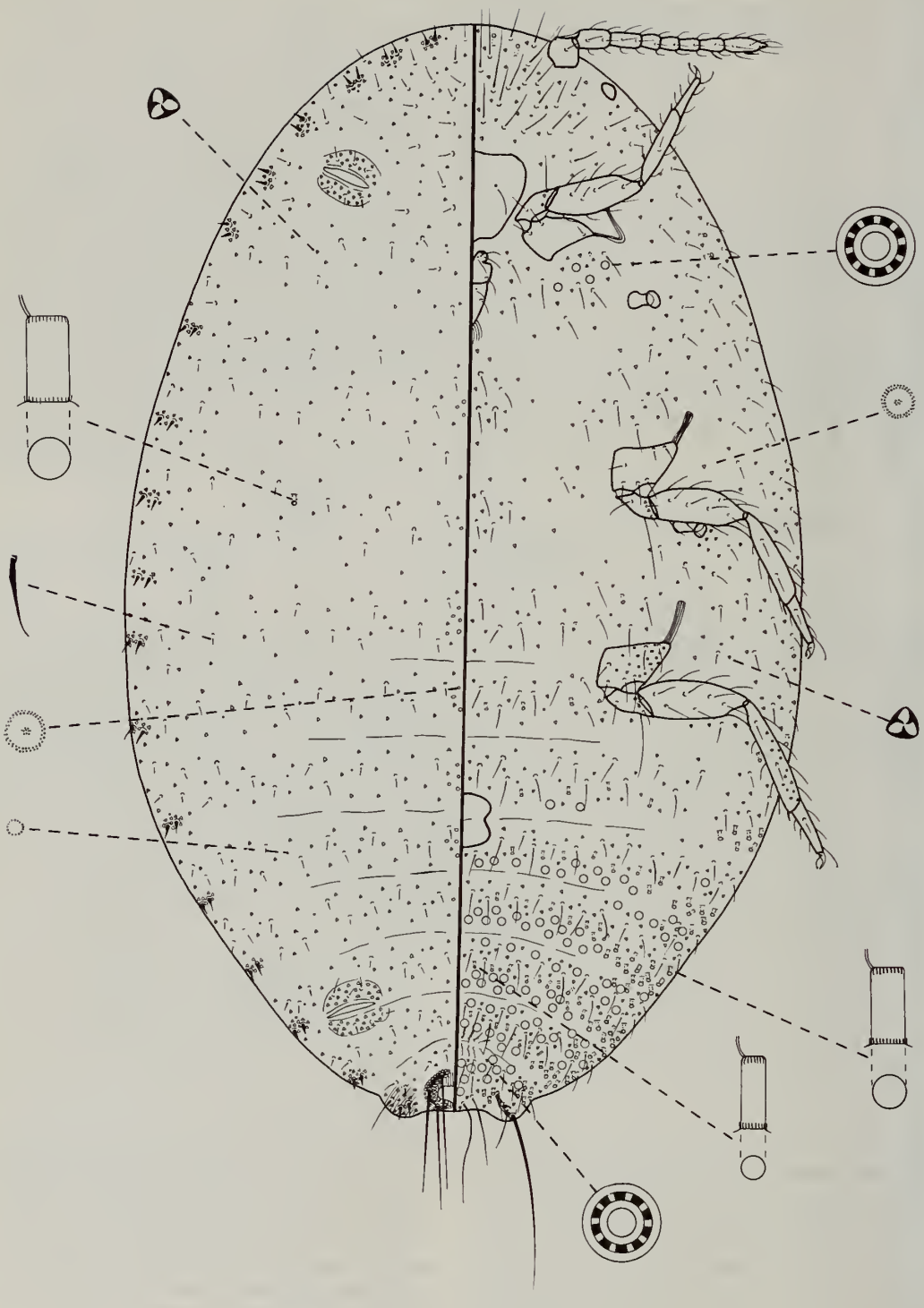

Fig. 27 *Planococcus minor* (Maskell).

dorsum; larger pores about twice the size of the trilocular pores, present in small groups along midline of thoracic and anterior abdominal segments. Setae flagellate and of moderate length, longest seta on abdominal segment VI or VII 25–30 μm long.

MATERIAL EXAMINED

Over 200 ♀ (including type material listed below) (BMNH, NZAC).

Dactylopius calceolariae var. *minor* Maskell. Lectotype ♀ here designated, on slide labelled: 'Dactylopius calceolariae var. minor, adult female, 1896, W. M. M.' (NZAC).

Planococcus pacificus Cox. Holotype ♀, **Western Samoa** (intercepted at Auckland, New Zealand): on croton leaves, 10.v.1979 (*C. Butcher*) (BMNH). 385 paratype ♀, reared from holotype in England, on potato tubers at various temperatures, 18.vi.1979–30.viii.1979 (*J. M. Cox*) (BMNH, NZAC, USNM).

DISTRIBUTION. Oriental Region: Bangladesh, Chagos Arch., Burma, India, Rodrigues I., Seychelles Is, Thailand. Austro-oriental Region: Borneo, West Malaysia, Papua New Guinea, Philippines, Singapore, Sumatra. Australian Region: New South Wales, Northern Territory, Queensland, South Australia. Polynesian Region: Solomon Islands, Austral Islands, Cook Islands, American Samoa, Fiji, Kiribati, Niue, Society Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Western Samoa. Neotropical Region: Barbados, Ecuador, Grenada, Jamaica, Trinidad, St Lucia, Virgin Islands. Malagasian Region: Madagascar, Mauritius.

HOSTPLANTS. Acanthaceae: *Pachystachys coccineae.* Agavaceae: *Furcraea gigantea.* Amaranthaceae: *Celosia* sp. Annonaceae: *Annona muricata.* Araceae: *Anthurium* sp., *Colocasia antiquorum, Dieffenbachia* sp. *Pistia stratiotes, Xanthosoma sagittifolium.* Asclepiadaceae: *Hoya* sp. Asteraceae: *Emilia sonifolia.* Cactaceae: *Harrisia portaricensis.* Cannaceae: *Canna* sp. Cucurbitaceae: *Luffa actangula.* Ebenaceae: *Diospyros discolor.* Ehretiaceae: *Cordia myxa.* Euphorbiaceae: *Alcalypha hispida, Cassava utilissima, Codiaeum variegatum Croton* sp. Geraniaceae: *Geranium* sp. Labiatae: *Epimeredi indicus, Ocimum sanctum.* Leguminosae: *Gliricidia maculata, Glycine max, Psophocarpus tetragonolobus, Tephrosia* sp. Liliaceae: *Asparagus* sp. Malvaceae: *Gossypium* sp. Marantaceae: *Maranta* sp. Moraceae: *Artocarpus communis, Ficus elastica.* Musaceae: *Musa sapientum.* Myrtaceae: *Psidium guajava.* Nyctaginaceae: *Boerhavia diffusa.* Palmae: *Chrysalidocarps* sp., *Howeia forsteriana.* Passifloraceae: *Passiflora edulis.* Periplocaceae: *Mondia citrifolia.* Piperaceae: *Piper nigrum.* Poaceae: *Bambusa* sp., *Orya sativa.* Polygonaceae: *Rumex* sp. Rosaceae: *Fragaria* sp. Rubiaceae: *Coffea arabica, C. liberica, C. robusta, Randia heterophylla.* Rutaceae: *Choisya* sp. Sapindaceae: *Nephelium lappaceum.* Sapotaceae: *Manilkara zapota.* Solanaceae: *Lycopersicon esculentum, Solanum grandiflorum, S. torrum, S. tuberosum.* Sterculiaceae: *Theobroma cacao.* Thunbergiaceae: *Thunbergia* sp. Verbenaceae: *Clerodendrum thompsonae, Verbena* sp. Many further host plants are listed by Williams (1982) under *P. pacificus*.

REMARKS. *Dactylopius calceolariae* var. *minor* was synonymized with *Planococcus citri* by Morrison (1925). The type material of the former taxon, however, although poor, appears to be the same species as that described as *P. pacificus* by Cox (1981). Additional evidence lies in the fact that no specimens of *P. citri* from the Malagasian Region were encountered during this study.

P. minor is very similar to *P. citri*, and the existence of the second species was not established until the variation of individual populations was studied using rearing experiments by Cox (1981, 1983) (see also under Introduction).

Although *P. citri* has frequently been recorded from the South Pacific Islands, Williams (1982) comments that most of these records are misidentifications of *P. minor*. His records show *P. minor* to be much more common than *P. citri* in this area, and to have been substantially longer established, the earliest record given of *P. citri* from the area being 1975 and that of *P. minor*, 1922

Likewise, Cox & Freeston (1985) showed that the species of *Planococcus* commonly occurring on *Theobroma cacao* in the Oriental and Neotropical Regions was in fact *P. minor* and not *P. citri*, although most published records are under the latter name.

ECONOMIC STATUS. *P. minor* is a common species on many economically important plants, particularly cocoa, throughout its geographical range.

Planococcus morrisoni (Ezzat & McConnell)

(Fig. 28)

Allococcus morrisoni Ezzat & McConnell, 1956: 17. Holotype ♀, PHILIPPINES: on *Lansium domesticum* (USNM) [examined].

Planococcus morrisoni (Ezzat & McConnell) Cox & Ben-Dov, 1986: 488.

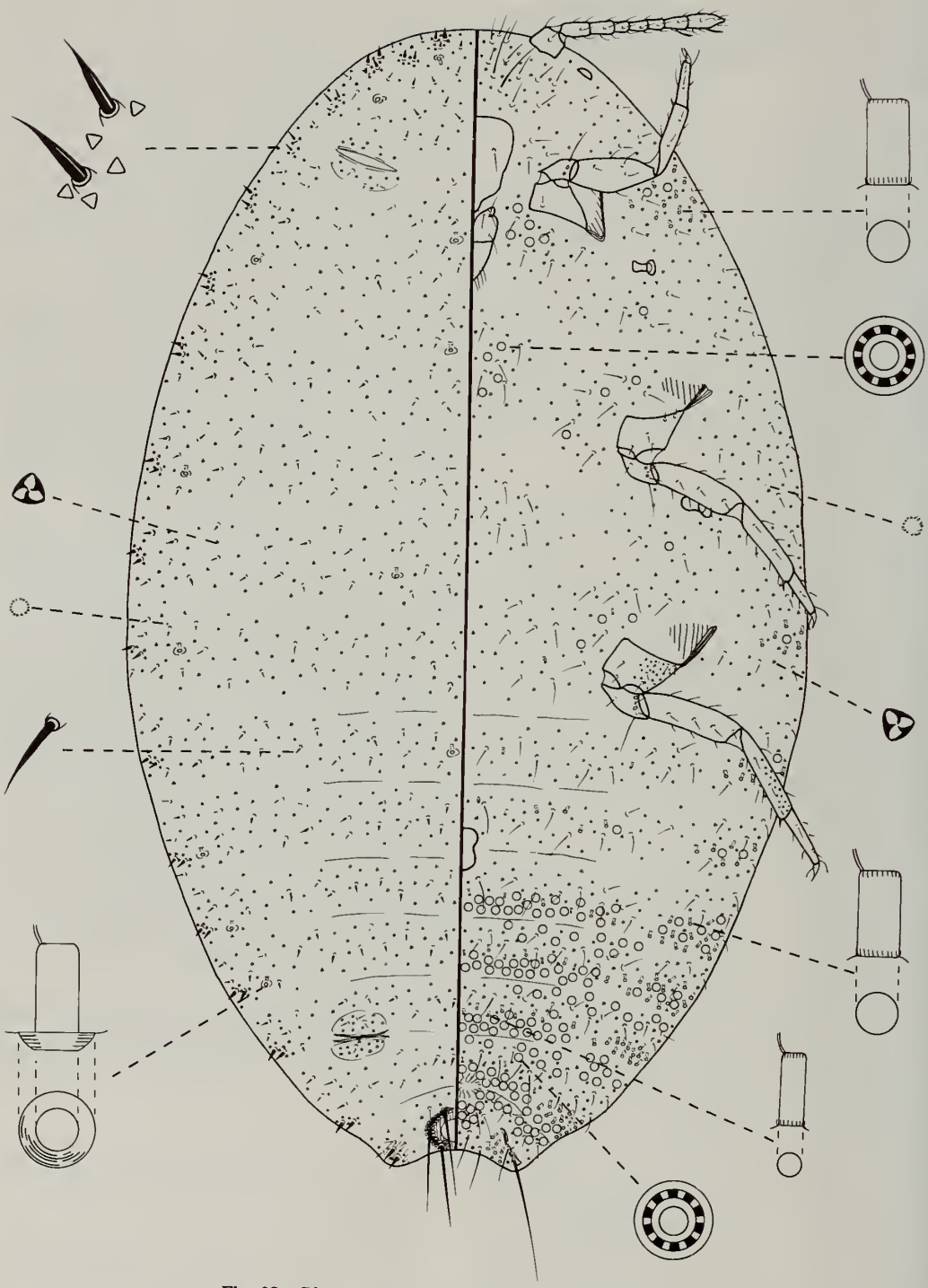

Fig. 28 *Planococcus morrisoni* (Ezzat & McConnell)

ADULT FEMALE. Mounted specimens elongate-oval, length 1.4–2.4 mm, width 0.6–1.3 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 slender conical setae, except for head and thorax where some cerarii may be indistinct and others with up to 4 conical setae. Legs elongate; hind trochanter + femur 210–285 μm long, hind tibia + tarsus 230–295 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.04–1.09; translucent pores apparent on hind coxae and tibiae. Inner edges of ostioles only slightly sclerotized. Circulus quadrate, width 40–115 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii situated on small, moderately sclerotized areas.

Venter. Multilocular disc pores present around vulva, in double rows across posterior edges of abdominal segments IV-VII and sometimes in a single row on segment III, scattered over anterior edges of segments V-VII; also present in small groups on margins of adominal segments I-VIII and scattered over median area of the thorax. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments IV-VII and scattered over median areas of thorax; larger size present sparsely in rows across median areas of abdominal segments III-VI, and in marginal groups on segments I-VIII and on prothorax adjacent to front coxae. Simple pores considerably smaller than the trilocular pores, sparsely scattered over venter.

Dorsum. Multilocular disc pores ducts absent. Tubular ducts, larger than the larger size on the venter and with distinct rims, present singly next to some cerarii and sparsely scattered over median areas. Trilocular pores and simple pores as for venter. Setae short and stout, almost lanceolate, longest seta on abdominal segments VI or VII 10–20 μm long.

MATERIAL EXAMINED

9 ♀ (including type material listed below) (BMNH, USNM).

Holotype ♀, **Philippines**, on *Lansium domesticum*, 30.viii.1951 (*R. O. Parsons*) (USNM).

DISTRIBUTION. Oriental Region: Thailand. Austro-oriental Region: Philippines, West Malaysia. All of these records are based on interceptions in the U.S.A.

HOSTPLANTS. Clusiaceae: *Garcinia mangostana*. Meliaceae: *Lansium domesticum*. Sapindaceae: *Litchi chinensis, Melicoccus bijugatus*.

REMARKS. The presence of marginal multilocular disc pores, short, stout, almost lancolate, dorsal setae, and a group of tubular ducts adjacent to each anterior coxa, whilst these ducts are absent from the head, show this species to be allied to *P. mali*. The large tubular ducts with pronounced oral rims, however, clearly distinguish *P. morrisoni*.

ECONOMIC STATUS. This species is frequently intercepted on fruit entering the U.S.A.

Planococcus nigritulus De Lotto
(Fig. 29)

Planococcus nigritulus De Lotto, 1961: 222. Holotype ♀, ZAIRE: on *Phoenix 'canariensis'* (given as *dactylifera* on the label) (BMNH) [examined].

ADULT FEMALE. Mounted specimens oval to rotund, length 1.9–2.4 mm, width 1.3–1.8 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 moderately stout conical setae. Legs somewhat stout; hind trochanter + femur 255–285 μm long, hind tibia + tarsus 245–275 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.93–1.10; translucent pores present on hind coxae and tibiae. Inner edges of lips of ostioles not noticeably sclerotized. Circulus large and quadrate, width 130–190 μm. Cisanal setae longer than anal ring setae. Anal lobe cerarii each situated on a very small, lightly sclerotized area.

Venter. Multilocular disc pores present around vulva, in rows across posterior edges of median areas of abdominal segments IV-VII and across anterior edges of segments VI or VII, and present in small marginal groups on segments IV-VII. Trilocular pores numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present in rows across median areas of abdominal segments V-VII; larger ducts occurring in rows across median areas of abdominal segments IV V and in marginal groups around entire venter except for abdominal segments VIII or IX from which they are entirely absent. Simple pores about twice the size of the trilocular pores, scattered over entire venter.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores of 2 sizes, larger pores the same size as those on the venter, in median groups on thoracic and anterior abdominal segments and scattered sparsely over thorax, smaller size slightly smaller than the trilocular pores, scattered over the abdominal segments. Setae flagellate, stout and moderately long, longest seta on abdominal segments VI or VII 25–40 μm long.

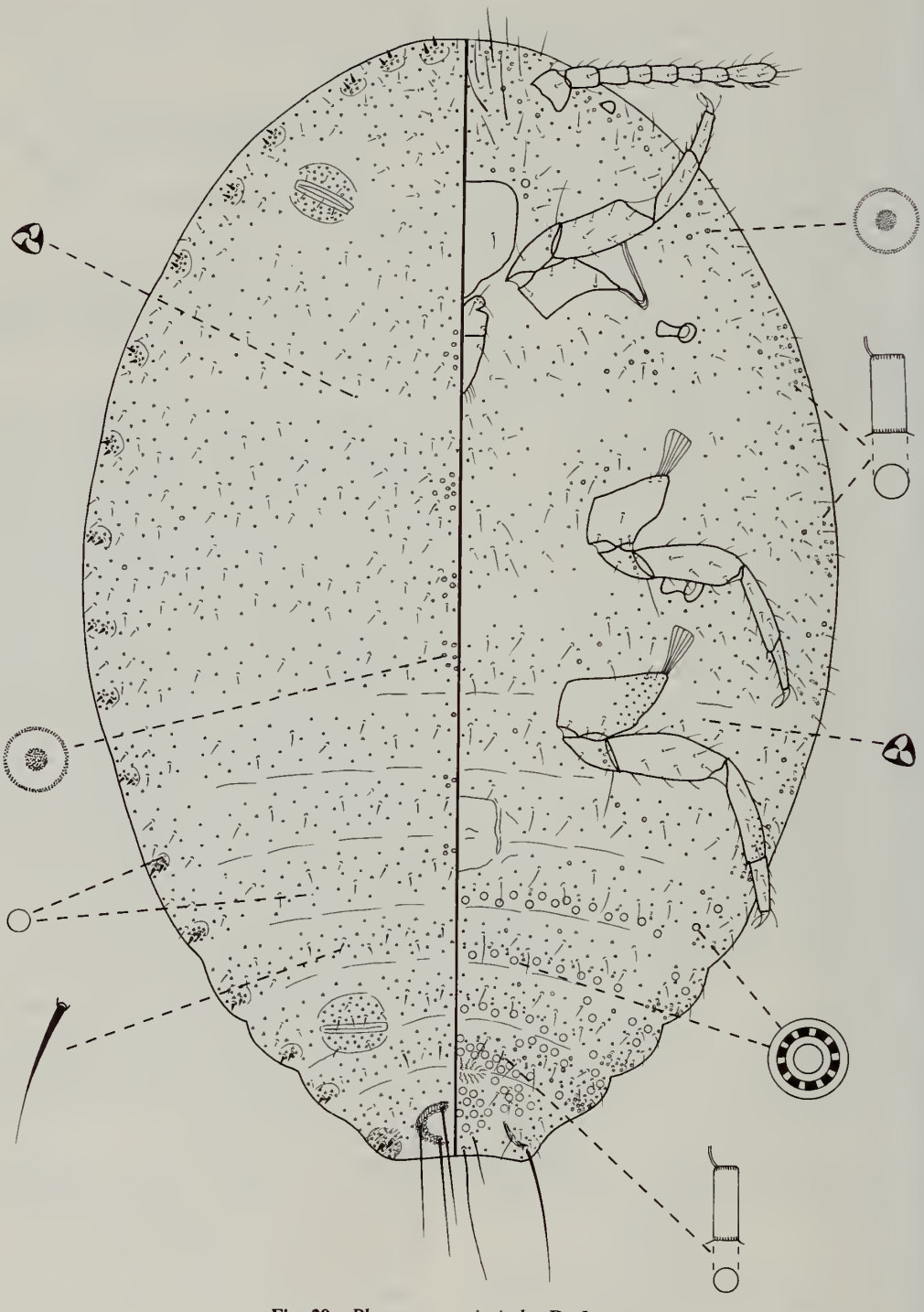

Fig. 29 *Planococcus nigritulus* De Lotto.

MATERIAL EXAMINED
Holotype ♀, **Zaire** (Belgian Congo): Katana, on *Phoenix dactylifera*, 15.x.1941 (*F. Hendrick*) (BMNH). 11 paratype ♀, same data as holotype (BMNH). The host is given as *P. canariensis* in the original description.

DISTRIBUTION. Afrotropical Region: Zaire. Also recorded from Tanzania (as Tanganyika) (De Lotto, 1964).

HOSTPLANTS. Palmae: *Phoenix dactylifera*. Also recorded from *Ficus* sp. (Moraceae) (De Lotto, 1964).

REMARKS. *P. nigritulus* is similar to *P. aemulor* and *P. tanzaniensis* in its rotund body shape, stout, almost fleshy, dorsal setae, large ventral simple pores, and absence of oral rim tubular ducts from abdominal segment IX. Unlike *P. nigritulus, P. aemulor* lacks both translucent pores on the hind legs and marginal tubular ducts on the venter. *P. tanzaniensis* possesses tubular ducts on the median areas of the thorax; these are absent in *P. nigritulus*.

Planococcus orchidi sp. n.

(Fig. 30)

ADULT FEMALE. Mounted specimens broadly oval to rotund, length 1.1–2.0 mm, width 1.0–1.5 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 stout conical setae. Legs stout; hind trochanter + femur 180–210 μm long, hind tibia + tarsus 175–220 μm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.96–1.05; translucent pores present on hind coxae and tibiae. Inner edges of ostioles well-sclerotized. Circulus small and quadrate, width 40–75 μm. Cisanal setae shorter than anal lobe setae. Anal lobe cerarii each situated on a small moderately sclerotized area.

Venter. Multilocular disc pores confined to median areas of abdomen, present around vulva and in single rows across posterior edges of median areas of abdominal segments V VI. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes, both confined to abdomen, smaller ducts present in single rows across median areas of abdominal segments V-VII, larger ducts present in small marginal groups on segments V-VII. Simple pores about twice the size of the trilocular pores, heavily sclerotized, and scattered over entire venter. Setae on median areas moderately long and fine, but those on margins short, moderately fine, and with distinctly knobbed tips.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores numerous and evenly distributed. Simple pores of 2 forms; pores slightly larger than the trilocular pores, and only lightly sclerotized, scattered sparsely over entire dorsum; heavily sclerotized pores, noticeably larger than the trilocular pores, present in small groups on midline of posterior abdominal segments. Setae moderately short and stout, and with distinctly knobbed tips. Longest seta of abdominal segments VI or VII 15–30 μm long.

MATERIAL EXAMINED
Holotype ♀, **Liberia** (intercepted at New York): on wild orchids, 10.x.1957 (*C. E. Andrews, J. Hidalgo*) (USNM).

Paratypes. 4 ♀, same data as holotype (BMNH, USNM).

DISTRIBUTION. Afrotropical Region: Liberia (intercepted in the U.S.A.).

HOSTPLANT. Orchidaceae.

REMARKS. *P. orchidi* resembles the Oriental species *P. dendrobii* and *P. philippinensis*, which also occur on orchids, in having few multilocular disc pores and tubular ducts, and in having dorsal setae which are distinctly knobbed. It may be distinguished from both of these species by the presence of translucent pores on the hind tibiae and by the large, heavily sclerotized simple pores on the venter. *P. orchidi* is also similar to two orchid-infesting Afrotropical species with knobbed dorsal setae, *P. hospitus* and *P. hosyni*, both of which lack marginal tubular ducts.

Planococcus philippinensis Ezzat & McConnell

(Fig. 31)

Planococcus philippinensis Ezzat & McConnell, 1956: 95. Holotype ♀, PHILIPPINES (intercepted in Hawaii): on orchids (USNM) [not examined].

ADULT FEMALE. Mounted specimens broadly oval to rotund, length 1.4–2.3 mm, width 1.0–1.9 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 stout conical setae. Legs stout; hind trochanter + femur about 240 μm long, hind tibia + tarsus about 220 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur about 0.92; translucent pores apparent on hind coxae only. Inner edges of ostioles apparently not sclerotized. Circulus absent. Cisanal setae longer that anal ring setae. Anal lobes apparently not sclerotized.

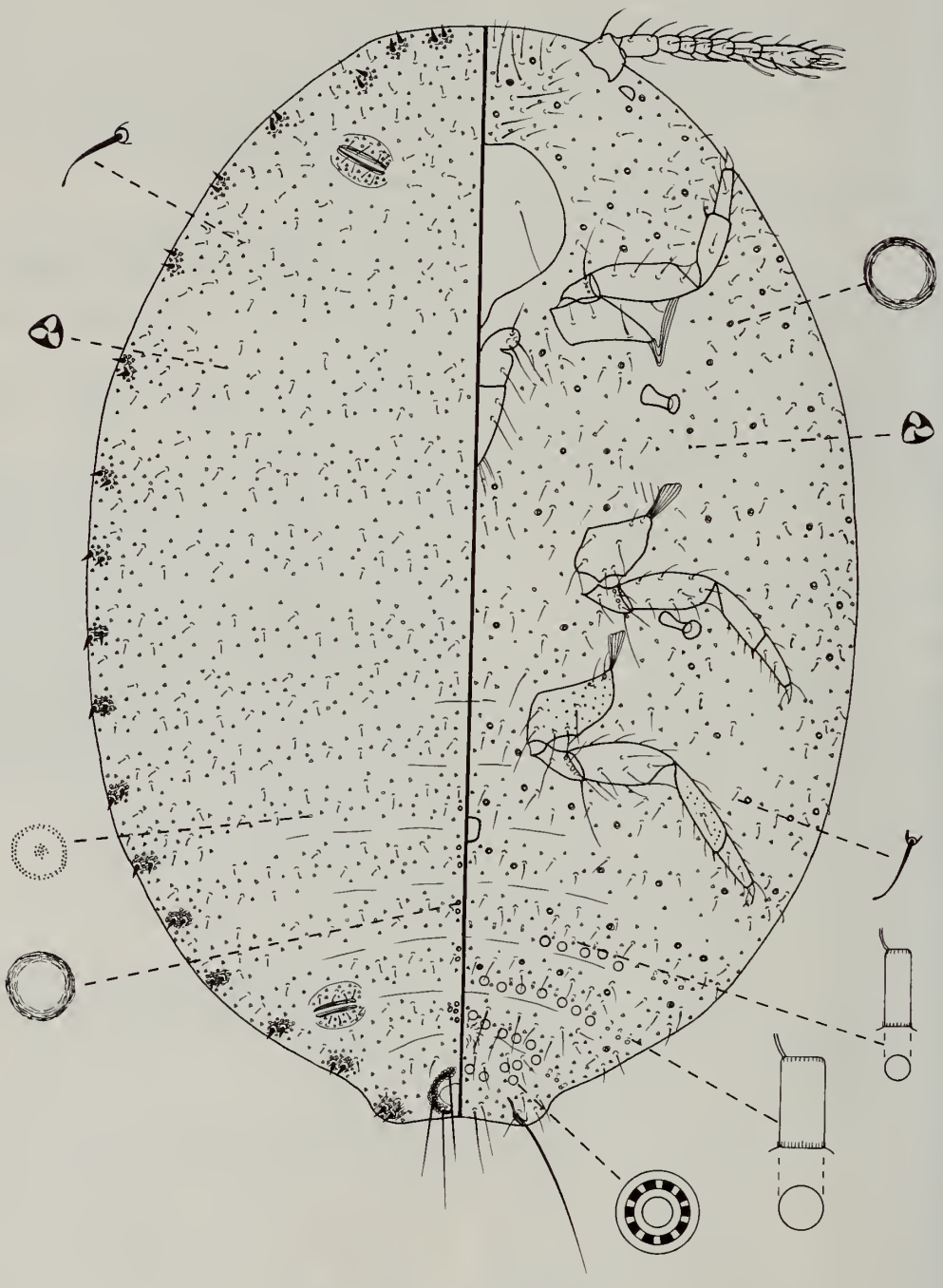

Fig. 30 *Planococcus orchidi* sp. n.

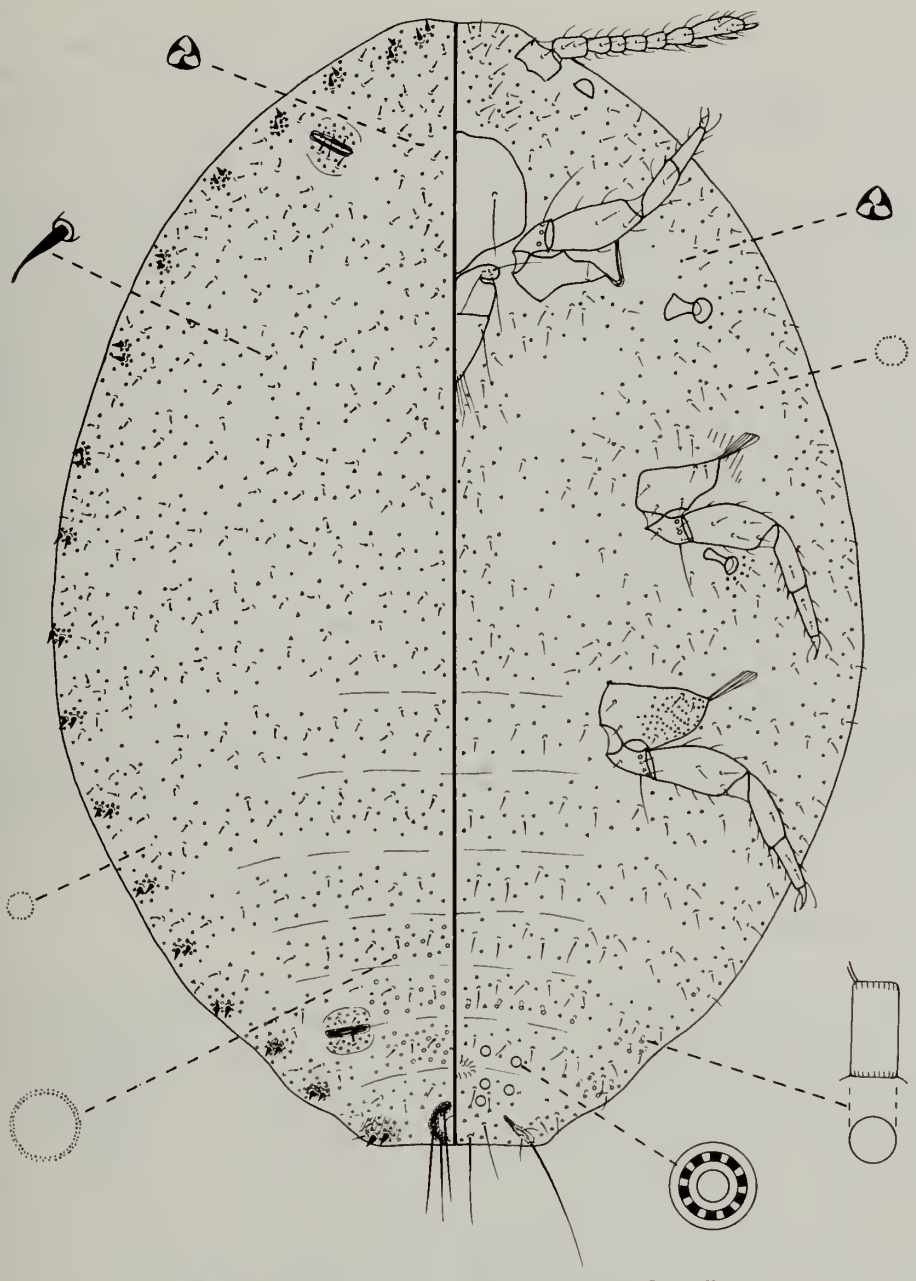

Fig. 31 *Planococcus philippinensis* Ezzat & McConnell.

Venter. Multilocular disc pores sparse and confined to median areas of abdomen, a few pores present around vulva and on posterior edges of median areas of abdominal segments V or VI. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 1 size only, confined to abdomen, present in rows across median areas of abdominal segments VI or VII, in marginal groups on segments VI or VII, and a few pores sometimes on margins of segment V. Simple pores about a third of the size of the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores, slightly smaller than the trilocular pores, sparsely scattered over most of dorsum, but those on median areas of abdominal segments numerous and noticeably larger than the trilocular

pores. Setae short and stout, slightly curved and with distinctly knobbed tips.

MATERIAL EXAMINED
1 paratype ♀, **Philippines** (intercepted at Honolulu): on *Vanda sanderiana*, 4.vi.1948 (*H. Making*) (USNM).

DISTRIBUTION. Austro-oriental Region: Philippines (intercepted in the U.S.A.).

HOSTPLANTS. Orchidaceae: *Vanda sanderiana*. Also recorded from *Cymbidium finlaysonianum*, *Vanda merrillii* and *Vandopsis lissochiloides* (all Orchidaceae) (Ezzat & McConnell, 1956).

REMARKS. This species is very similar to *P. dendrobii*, also from the Oriental Region, in having reduced numbers of tubular ducts and multilocular disc pores, translucent pores absent from the hind tibiae and dorsal setae which are short, stout and knobbed. *P. dendrobii*, however, has a circulus, and the simple pores on the dorsum of abdominal segments VI or VII are smaller than the trilocular pores. Together, these two species are probably the sister-group of two African species which also occur on orchids, *P. hosyni* and *P. orchidi*. These latter species also have knobbed dorsal setae (although indistinct in *P. hosyni*), but are distinguishable from the Oriental species by having translucent pores on the hind tibiae.

ECONOMIC STATUS. This species is a potential pest of orchids.

Planococcus principe sp. n.

(Fig. 32)

ADULT FEMALE. Mounted specimens broadly oval to rotund, length 1.6–2.8 mm, width 1.2–2.1 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarii with 2 (3 or 4 in preocular cerarii) conical setae. Legs stout; hind trochanter + femur 275–295 μm long, hind tibia + tarsus 240–270 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.84–0.92; translucent pores present on hind coxae and tibiae. Inner edges of ostioles moderately well sclerotized. Circulus quadrate, width 125–180 μm. Cisanal setae about the same length as the anal ring setae. Anal lobe area moderately well sclerotized.

Venter. Multilocular disc pores present around vulva, in rows across posterior edges of abdominal segments IV-VII and forming marginal groups on segments V or VI; a few pores sometimes present on the head. Trilocular pores numerous and evenly distributed. Oral collar tubular ducts very small, in rows across median areas of abdominal segments V-VII and in marginal groups on head, prothorax and abdominal segments V-VII; a single larger duct sometimes present on margin of segment V. Simple pores about three quarters of the size of the multilocular disc pores, scattered over venter.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores as for venter. Simple pores of various sizes, larger pores about the same size as those on the venter, forming a group on the midline of each thoracic segment and scattered over submarginal areas of head and thorax, slightly smaller pores scattered over median areas of anterior abdominal segments. Setae moderately long and stout, those on the thorax sometimes distinctly knobbed, length of longest seta on abdominal segments VI or VII 30–40 μm.

MATERIAL EXAMINED
Holotype ♀, **Principe:** on cocoa, 1956 (*F. J. Simmonds*) (BMNH).
Paratypes. 7 ♀, same data as holotype (BMNH).

DISTRIBUTION. Afrotropical Region: Principe.

HOSTPLANT. Sterculiaceae: *Theobroma cacao*.

REMARKS. The only other known species of *Planococcus* which has simple pores of almost the same size as the multilocular disc pores is *P. hospitus*. The presence of marginal multilocular disc pores in *P. principe* distinguishes the 2 species.

Planococcus psidii sp. n.

(Fig. 33)

ADULT FEMALE. Mounted specimens oval, length 1.4–2.7 mm, width 0.7–1.8 mm. Margin of body with complete series of 18 pairs of ceraii, each cerarius with 2 slender conical setae. Legs elongate; hind trochanter + femur 245–285 μm, hind tibia + tarsus 255–325 μm, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.04–1.18; large transparent pores very conspicuous on hind coxae and tibiae. Inner edges of ostioles wll sclerotized. Circulus quadrate, width 105–145 μm. Cisanal setae shorter than anal lobe setae.

Venter. Multilocular disc pores present around vulva, in rows across posterior edges of median areas of abdominal segments III-VII and across anterior edges of segments V-VII, occurring in marginal groups on segments IV-VIII, a few pores also present on median areas of the thorax. Trilocular pores sparsely but evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present in rows across median areas of posterior abdominal segments; larger ducts present in rows across anterior abdominal segments, scattered

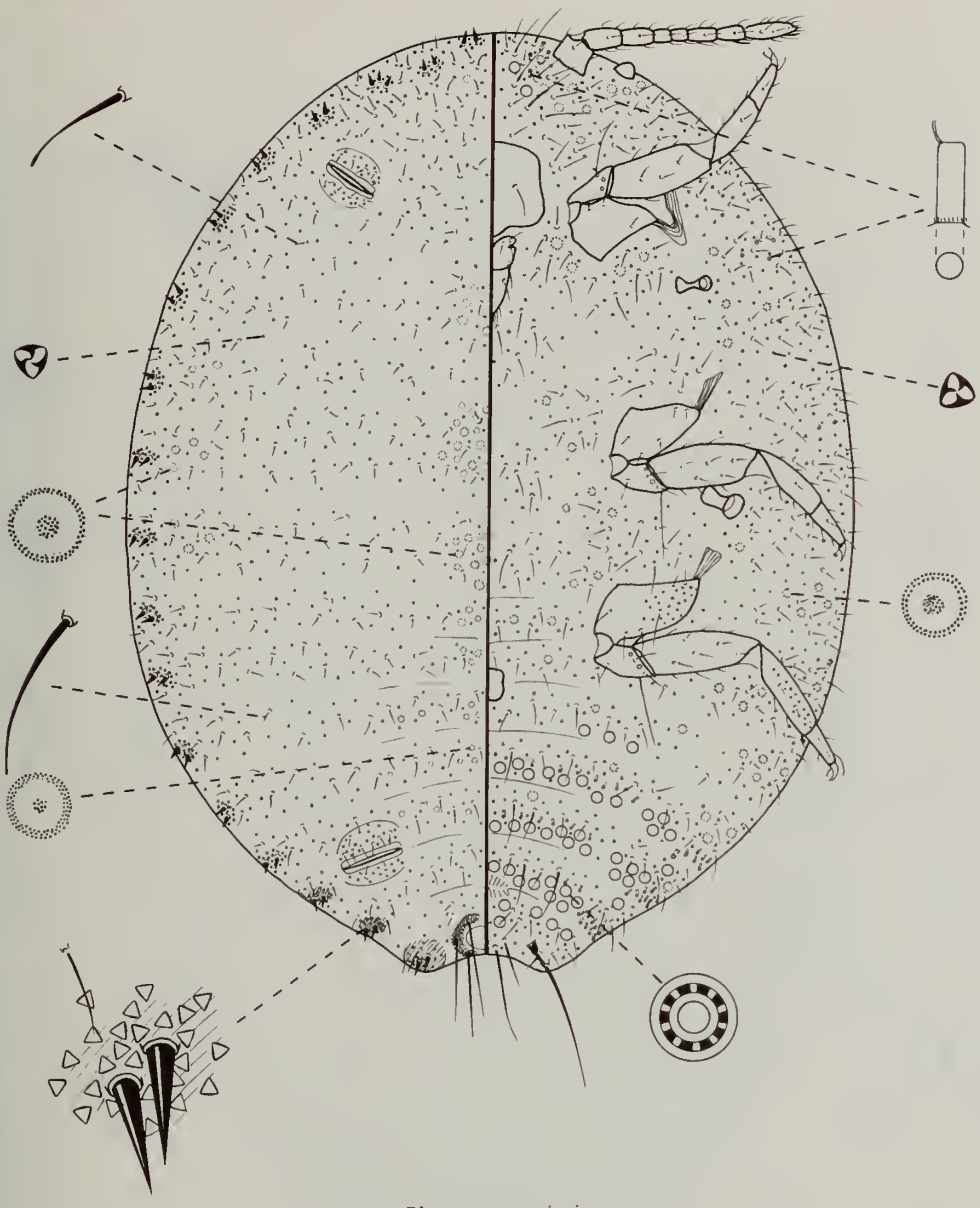

Fig. 32 *Planococcus principe* sp. n.

over median areas of thorax, occurring singly on margins of head and thoracic segments and present in marginal groups on abdomen. Simple pores about the same size as the trilocular pores, sparsely scattered over entire venter.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores sparse and some appear to be associated with the bases of the larger setae. Simple pores of 2 sizes, smaller pores minute and sparsely scattered over entire dorsum, larger pores about the same size as those on the venter and forming a small group on the midline of each thoracic and anterior abdominal segment. Setae short and stout, blunt-ended or slightly knobbed, length of longest seta on abdominal segments VI or VII 15–22 μm.

MATERIAL EXAMINED

Holotype ♀, **West Malaysia:** Flemming Est., on *Psidium guajava*, 21.i.1988 (*K. C. Khoo*) (BMNH).

Paratypes. 11 ♀, same data as holotype (BMNH).

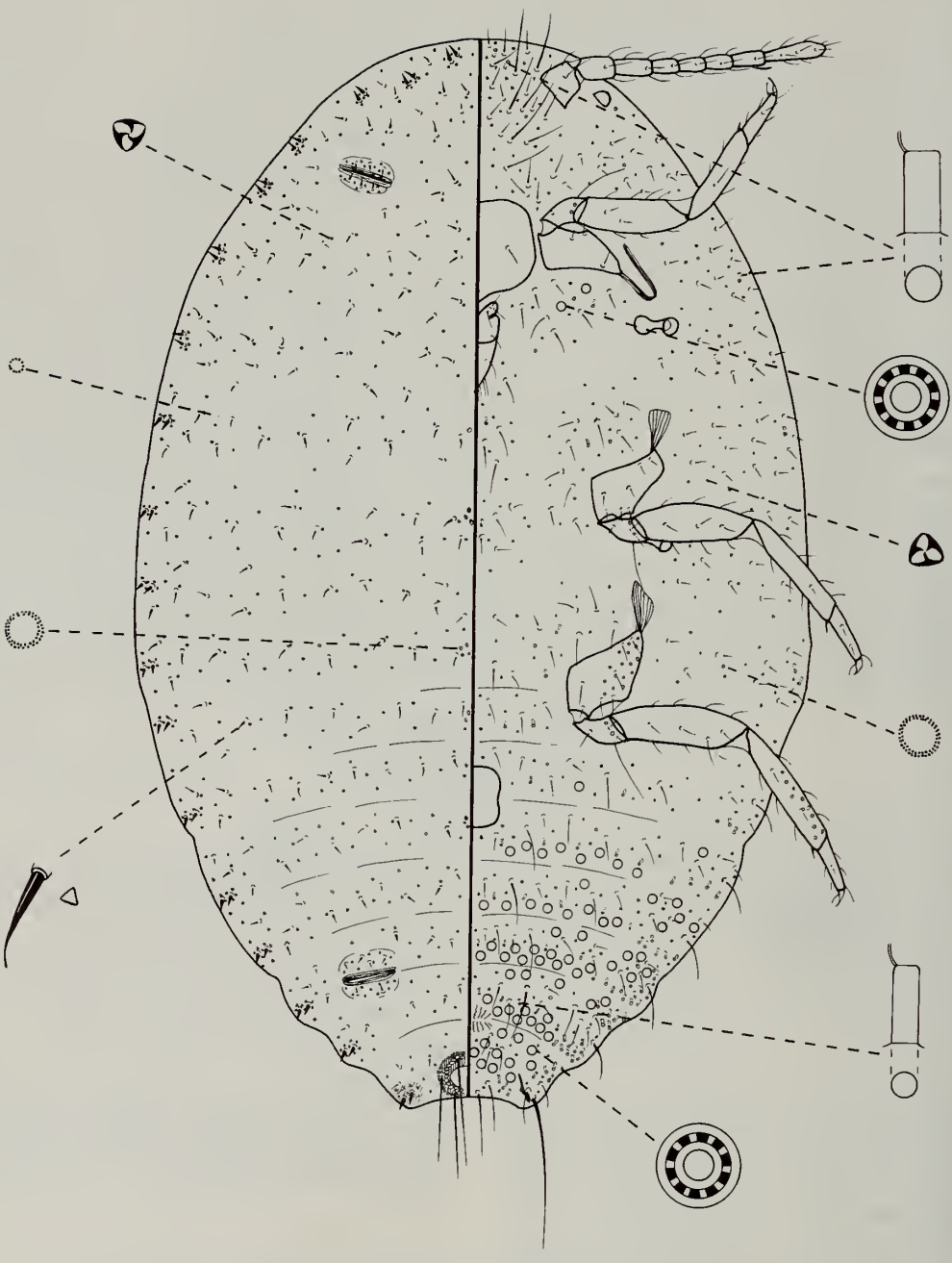

Fig. 33 *Planococcus psidii* sp. n.

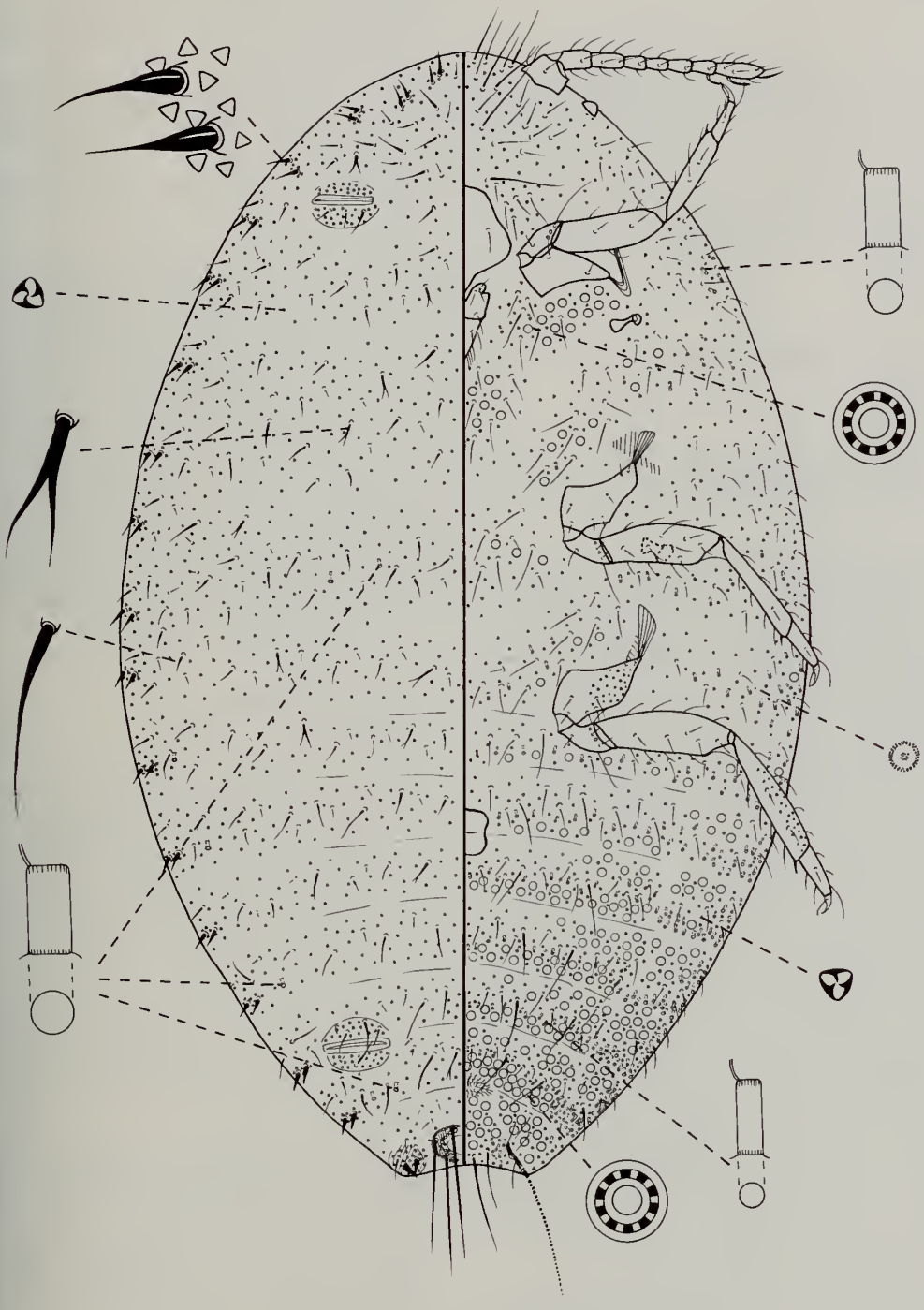

Fig. 34 *Planococcus subterraneus* De Lotto.

DISTRIBUTION. Austro-oriental Region: West Malaysia.

HOST. Myrtaceae: *Psidium guajava*.

REMARKS. *P. psidii* is superficially similar to *P. minor* in its distribution of multilocular disc pores and oral collar tubular ducts. However, the short blunt-ended dorsal setae and the large translucent pores on the hind legs distinguish *P. psidii*. This species may actually be more closely related to the *dorsospinosus*-group, as the trilocular pores are somewhat associated with some of the larger dorsal setae.

Planococcus subterraneus De Lotto

(Fig. 34)

Planococcus subterraneus De Lotto, 1964: 377. Holotype ♀, SOUTH AFRICA: Pretoria, on roots of *Ficus* sp. (BMNH) [examined].

ADULT FEMALE. Mounted specimen elongate-oval, length 2.3 mm, width 1.4 mm. Margin of body with complete series of 18 pairs of cerarii, each cerarius with 2 slender conical setae. Legs elongate; hind trochanter + femur 375 μm long, hind tibia + tarsus 405 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.08; translucent pores present on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate, width 170 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores numerous around vulva, present in rows across posterior edges of median areas of all abdominal segments and across anterior edge of segments IV-VII, present in marginal groups on abdominal segments II-VIII, and numerous over median area of thorax. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of all abdominal segments; slightly larger ducts sparsely scattered over median areas of head and thorax, in marginal groups on all abdominal segments, and a few ducts present on margins adjacent to front coxae. Simple pores about half the size of the trilocular pores, sparsely but evenly distributed.

Dorsum. Multilocular disc pores absent. Tubular ducts, larger than the larger ducts on the venter and without noticeable rims, present singly adjacent to some abdominal cerarii (except for one side of the preanal segment on which 2 ducts are present), and a few ducts scattered over median areas of the thorax. Trilocular pores as for venter. Simple pores not apparent. Setae long, stout and flagellate, some strongly bifurcate, longest seta on abdominal segments VI or VII about 75 μm long.

MATERIAL EXAMINED

Known from holotype ♀ only, **South Africa:** Pretoria, on roots of *Ficus* sp., 15.viii.1958 (*H. K. Munro*) (BMNH).

DISTRIBUTION. Afrotropical Region: South Africa.

HOSTPLANT. Moraceae: *Ficus* sp.

REMARKS. *P. subterraneus* is very similar to *P. flagellatus* in its distribution of multilocular disc pores and possession of long, fleshy dorsal setae. It differs primarily by having many bifurcate dorsal setae and by lacking tubular ducts on the head. As *P. subterraneus* is known from a single specimen, and *P. flagellatus* from only a few specimens which vary greatly, it is possible that further collecting may show these two species to be the same.

Both *P. subterraneus* and *P. flagellatus* belong to the *citri*-group by virtue of their arrangement of multilocular disc pores and tubular ducts. Their distinctive characteristic is the very long, fleshy and sometimes bifurcate, dorsal setae.

Planococcus sulawesi sp. n.

(Fig. 35)

ADULT FEMALE. Mounted specimens oval, length 1.6–1.7 mm, width 0.8–0.9 mm. Margin of body with a complete series of 18 pairs of cerarii, each cerarius with 2 stout conical setae. Legs elongate; hind trochanter + femur 285–305 μm long, hind tibia + tarsus 305–325 μm long, ratio of hind tibia + tarsus to hind trochanter + femur 1.06–1.07; translucent pores present on hind coxae and tibiae. Inner edges of ostioles lightly sclerotized. Circulus quadrate and of moderate size, width about 135 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small sclerotized area.

Venter. Multilocular disc pores confined to median areas of body, present around vulva and in rows across posterior edges of abdominal segments III-VII and across anterior edges of segments VI or VII; a few pores scattered over thorax. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present in rows across median areas of abdominal segments IV-VII; larger ducts present in rows across median areas of segments II-VII, in marginal groups on all thoracic and abdominal segments, and scattered over

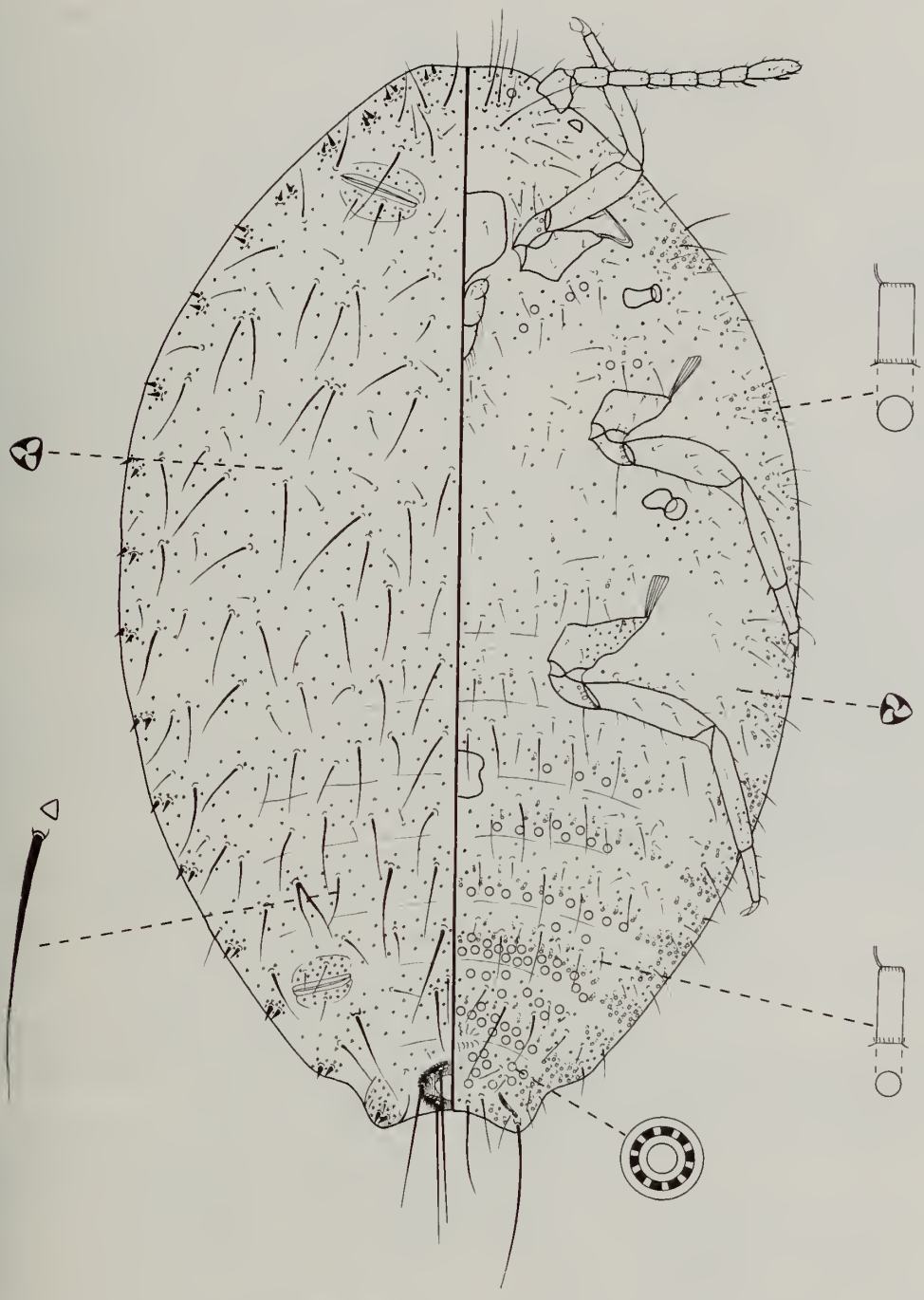

Fig. 35 *Planococcus sulawesi* sp. n.

median areas of thorax. Simple pores not apparent in the specimens examined.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores moderately numerous and slightly aggregated around the bases of the larger setae. Simple pores not apparent in the specimens examined. Setae stout and very long, occasionally bifurcate, length of longest seta on abdominal segment VI or VII about 100 μm.

MATERIAL EXAMINED

Holotype ♀, **Indonesia:** Sulawesi Utara, Dumoga-Bone National Park, Gunung Mogogonipa, on Urticaceae, 6.iv.1985 (*J. H. Martin*) (BMNH).

Paratype. 1 ♀, same data as holotype (BMNH).

DISTRIBUTION. Austro-oriental Region: Indonesia.

HOSTPLANT. Urticaceae.

REMARKS. *P. sulawesi* is a member of the *dorsospinosus*-group by virtue of its arrangement of multilocular disc pores and tubular ducts, and by having trilocular pores associated with the bases of the larger dorsal setae. It is readily distinguished from the other members of this group by its very long dorsal setae. *P. sulawesi* superficially resembles *P. flagellatus*, *P. subterraneus* and *P. lilacinus* in the length of its dorsal setae, but can be distinguished from the former two species, both Afrotropical, by lacking marginal multilocular disc pores, from *P. lilacinus* by having multilocular disc pores present on the thorax and by having elongate legs, and from all three by having trilocular pores associated with the bases of the dorsal setae.

Planococcus taigae Danzig

(Fig. 36)

[*Planococcus vovae* (Nasonov) Danzig, 1980: 168, in part, illustration. Misidentification.]

Planococcus taigae Danzig, 1986: 19. Holotype ♀, U.S.S.R: Southern Sakhalin, on *Juniperus sibirica* (ZIL) [not examined].

ADULT FEMALE. Mounted specimens oval, length 1.4–2.3 mm, width 1.0–1.7 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 slender, conical setae, noticeably more slender and flagellate towards the anterior end of the body. Legs elongate; hind trochanter + femur 210–295 μm long, hind tibia + tarsus 220–315 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.05–1.06; translucent pores present on hind coxae and 2–4 pores just visible on each hind tibia. Ostioles very weakly defined. Circulus not apparent in specimens examined, but indicated in illustration by Danzig (1980). Cisanal setae shorter than anal lobe setae. Anal lobe cerarii each situated on a small, lightly sclerotized area.

Venter. Multilocular disc pores confined to median areas only, situated around vulva, in rows across posterior edges of abdominal segments IV-VII, and a few pores present on anterior edges of segments V-VII. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes, smaller ducts present sparsely in rows across median areas of abdominal segments V-VII, larger ducts present in rows across median areas of segments II-VII and numerous around margin of entire venter. Simple pores minute, sparsely but evenly distributed.

Dorsum. Multilocular disc pores absent. Trilocular pores and simple pores as for venter. Tubular ducts, variable in size but larger than those on the venter and without apparent rims, numerous over entire dorsum, occurring in rows of up to 24 ducts across abdominal segments. Setae short and stout, longest setae on abdominal segments VI or VII about 13 μm long.

MATERIAL EXAMINED

2 paratype ♀, **U.S.S.R:** Primorye Region, Sudzukhinskiy Nature Reserve, on *Juniperus rigida*, 15.vii.1969 (*E. Danzig*); 1 paratype ♀, Southern Sakhalin, Staroduskoye, 4.vii.1968 (*S. Barfeneva*) (all BMNH).

DISTRIBUTION. Palaearctic Region: U.S.S.R., from Karelia to Kuril Islands (Danzig, 1980).

HOSTPLANTS. Cupressaceae: *Juniperus communis, J. rigida, J. siberica* (Danzig, 1986).

REMARKS. The above description was based on only three specimens, so the ranges of characters given may be less than actually occurs throughout the species.

P. taigae is very similar to *P. vovae* which also occurs only on Cupressaceae, and replaces the latter species in the eastern Palaearctic Region. *P. taigae* can be distinguished from *P. vovae* by its greater numbers of dorsal tubular ducts (total of more than 200), presence of ventral tubular ducts on the head, and indistinct ostioles. *P. vovae* has variable numbers of dorsal tubular ducts, but never more than a total of 110, lacks ventral tubular ducts on the head and has well-defined ostioles. Both of these species are similar to *Crisicoccus matesovae* (Fig. 37), also occurring on

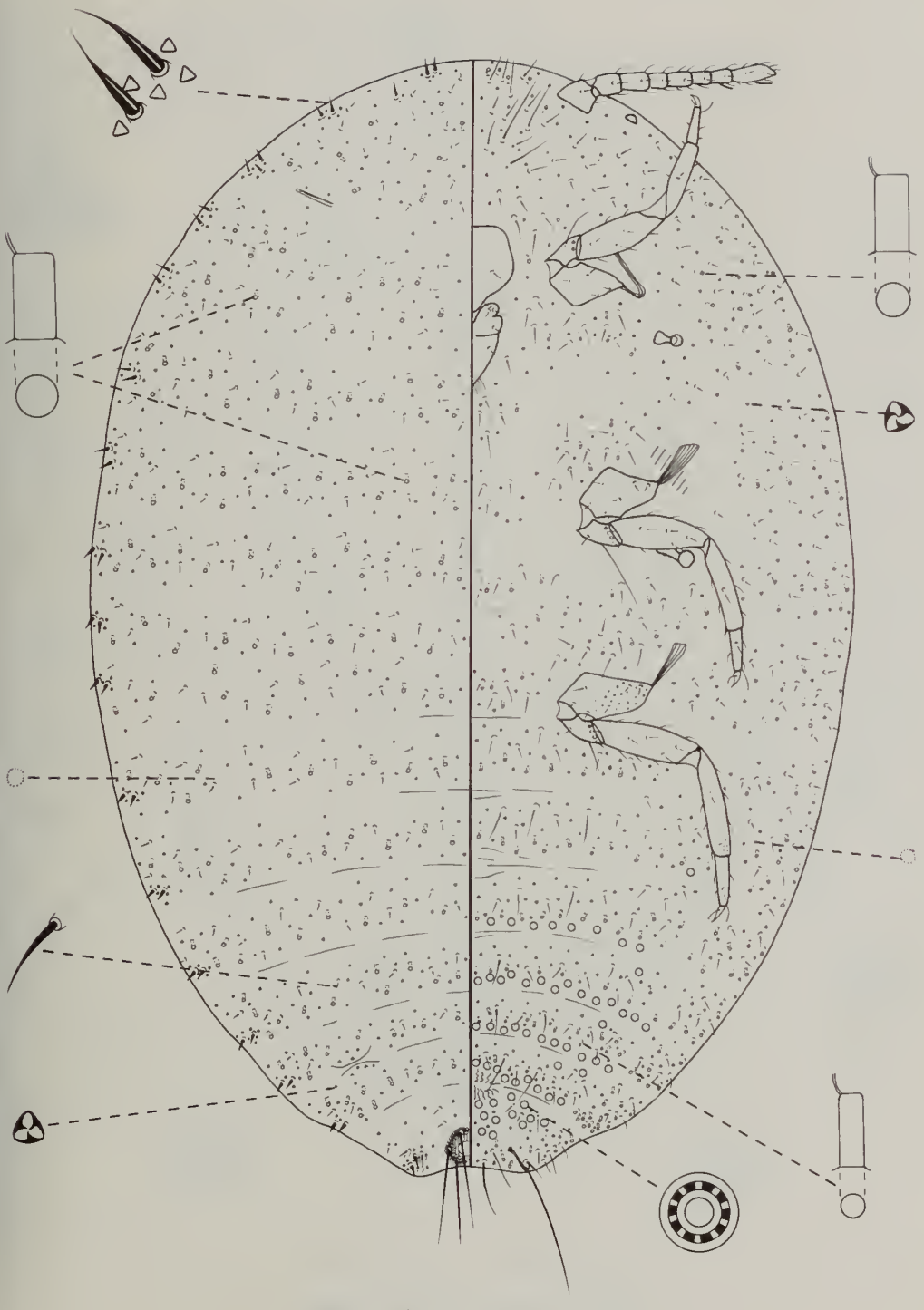

Fig. 36 *Planococcus taigae* Danzig.

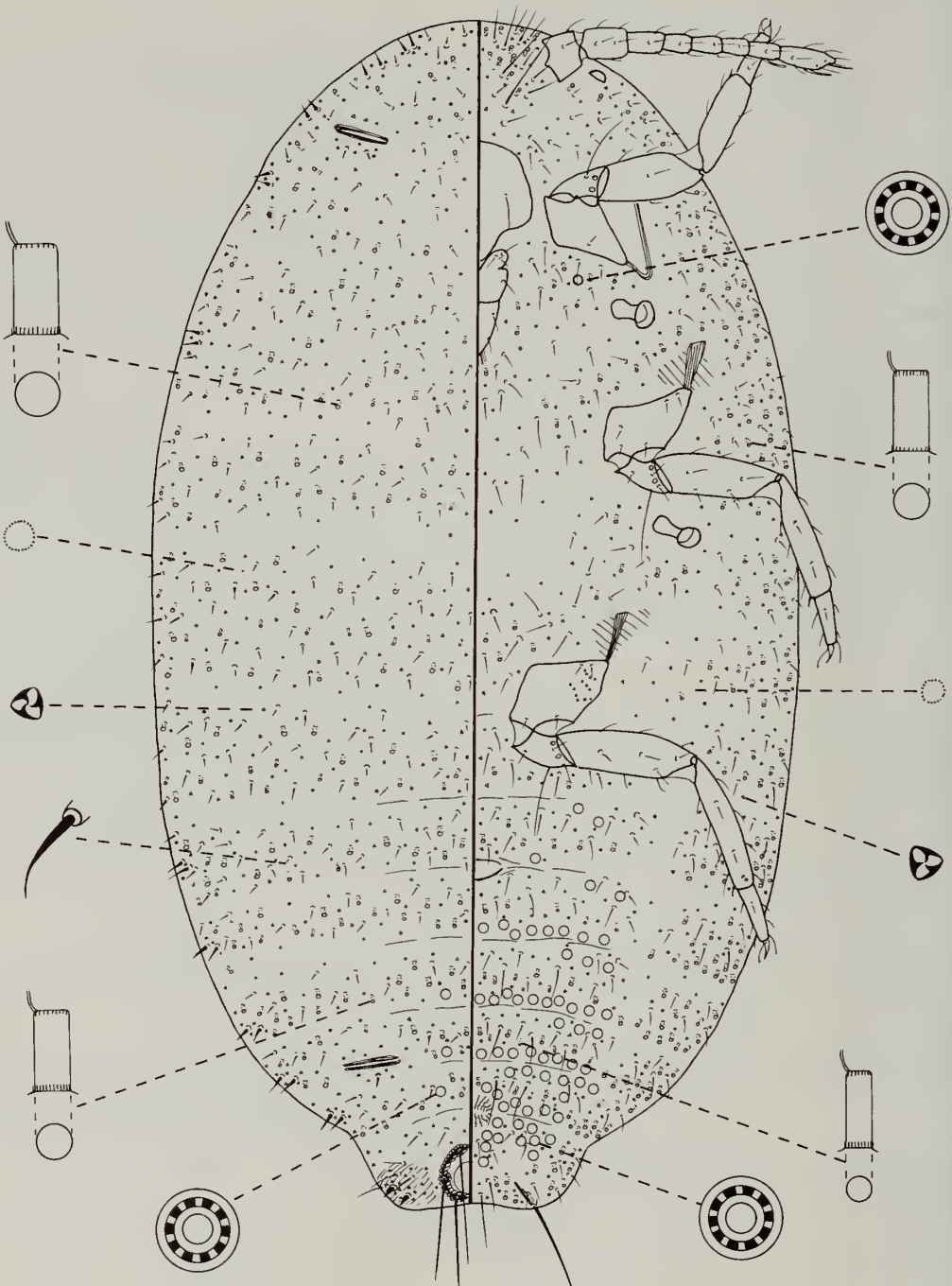

Fig. 37 *Crisicoccus matesovae* (Danzig).

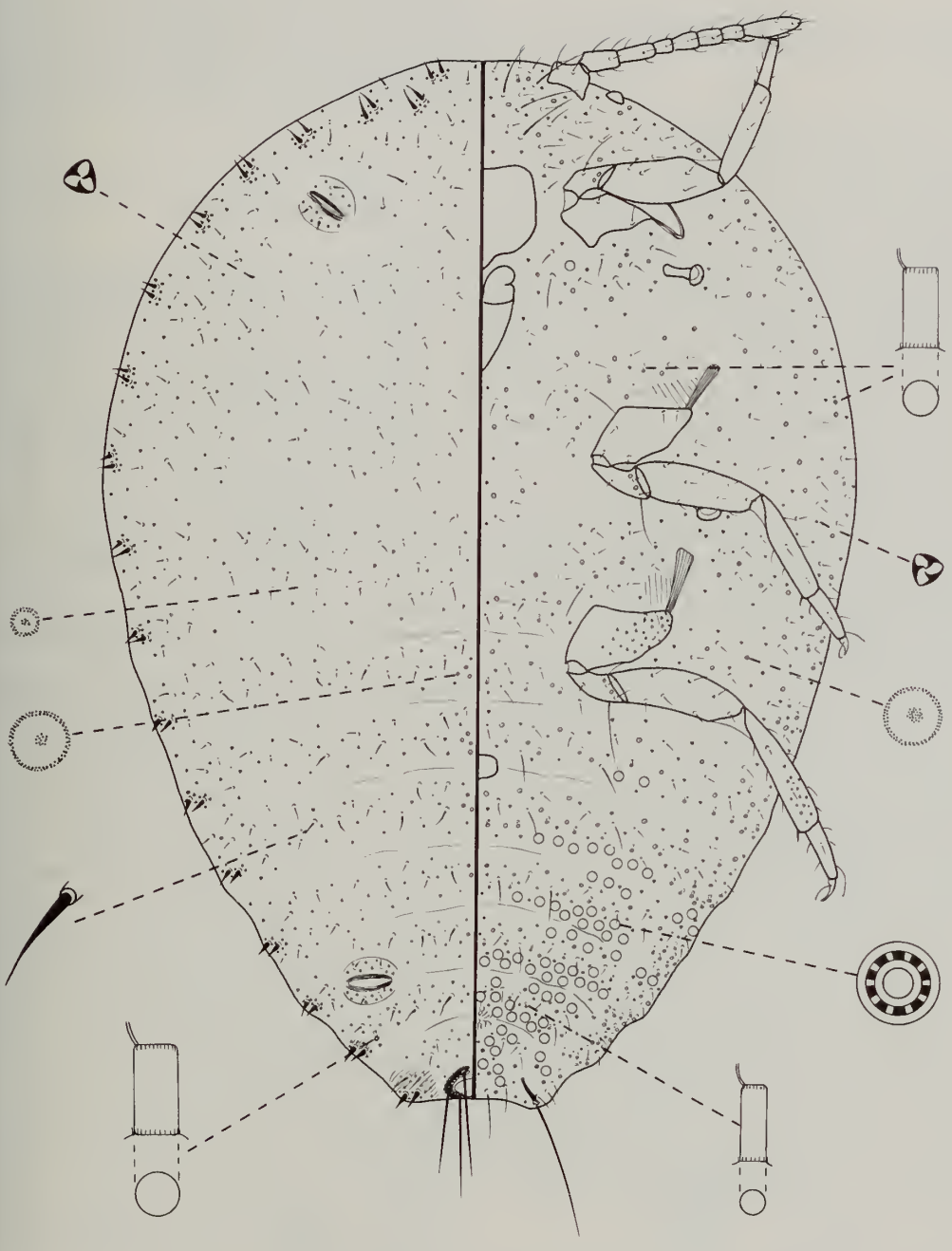

Fig. 38 *Planococcus tanzaniensis* sp. n.

Cupressaceae in the U.S.S.R., but this species has dorsal multilocular disc pores and fewer than 18 pairs of cerarii.

Planococcus tanzaniensis sp. n.

(Fig. 38)

Adult female. Mounted specimens broadly oval to rotund, length 1.5–2.5 mm, width 1.1–2.0 mm. Margin of body with a complete series of 18 pairs of cerarii, each cerarius with 2 moderately stout conical setae. Legs elongate; hind femur + trochanter 250–305 μm long, hind tibia + tarsus 295–345 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.09–1.18; translucent pores present on hind coxae and tibiae. Inner edges of lips of ostioles moderately sclerotized. Circulus quadrate, width 95–125 μm. Cisanal setae shorter than anal ring setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores present around vulva, in rows across posterior edges of median areas of abdominal segments IV-VII and across anterior edges of segments V-VII, and present in small numbers on margins of segments V-VII. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present in rows across median areas of abdominal segments; larger ducts scattered over median areas of thorax, present in small numbers on margins of head and thoracic segments, and in small groups on margins of all abdominal segments except segment IX and sometimes VIII. Simple pores about the same size as the trilocular pores, moderately numerous and scattered over entire venter.

Dorsum. Multilocular disc pores absent. Trilocular pores as for venter. Tubular ducts, larger than the larger size on the venter and without apparent rims, sometimes present singly adjacent to posterior cerarii. Simple pores of 2 sizes, larger simple pores slightly larger than the trilocular pores, present in small median groups on anterior abdominal segments, smaller pores, about half the size of the trilocular pores, scattered over entire dorsum. Setae flagellate, long and stout, longest seta on abdominal segments VI or VII about 30 μm long.

Material examined

Holotype ♀, **Tanzania:** Selem, on *Hevea braziliensis*, 8.i.1987 (*S. Oswald*) (BMNH).

Paratypes. 13 ♀, same data as holotype (BMNH).

Distribution. Afrotropical Region: Tanzania.

Hostplant. Euphorbiaceae: *Hevea braziliensis*.

Remarks. *P. tanzaniensis* is most similar to *P. aemulor* and *P. nigritulus* in its body shape, distribution of multilocular disc pores, large ventral simple pores, long stout dorsal setae and absence of tubular ducts from abdominal segment IX. It can be distinguished from both species by its possession of tubular ducts on the median areas of the thorax.

Planococcus vovae Nasonov

(Fig. 39)

Pseudococcus (Dactylopius) vovae Nasonov, 1908: 484. Lectotype ♀, U.S.S.R.: on *Juniperus communis* (ZIL) designated by Danzig (1980) [examined].

Pseudococcus inamabilis Hambleton, 1935: 112. Syntype ♀, Brazil: on *Cupressus glauca* (IBSP, ?lost) [not examined]. [Synonymized by Cox & Ben-Dov (1986).]

Allococcus inamabilis (Hambleton) Ezzat & McConnell, 1956: 15.

Allococcus vovae (Nasonov) Zahradnik, 1959: 537.

Planococcus vovae (Nasonov) Danzig, 1980: 168; Cox & Ben-Dov, 1986: 485; Danzig, 1986: 18.

Adult female. Mounted specimens oval, length 1.3–3.4 mm, width 0.7–2.3 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2 slender conical setae, noticeably more slender and flagellate towards the anterior end of the body. Legs elongate; hind trochanter + femur 230–355 μm long, hind tibia + tarsus 265–400 μm long, ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.09–1.17; translucent pores present on hind coxae and a few pores sometimes visible on each hind tibia. Ostioles well defined, but with lip edges weakly sclerotized. Circulus quadrate, width 75–135 μm. Cisanal setae shorter than anal lobe setae. Anal lobe cerarii each situated on a small, lightly sclerotized area.

Venter. Multilocular disc pores confined to median areas of abdomen, situated around vulva and in rows across posterior edges of abdominal segments IV-VII, and a few pores present on anterior edges of segments V-VII. Trilocular pores moderately numerous and evenly distributed. Oral collar tubular ducts of 2 sizes; smaller ducts present sparsely in rows across median areas of abdominal segments V-VII; larger ducts present in rows across median areas of segments II-VII, in marginal groups on all abdominal segments and scattered over median areas of thorax, and a few

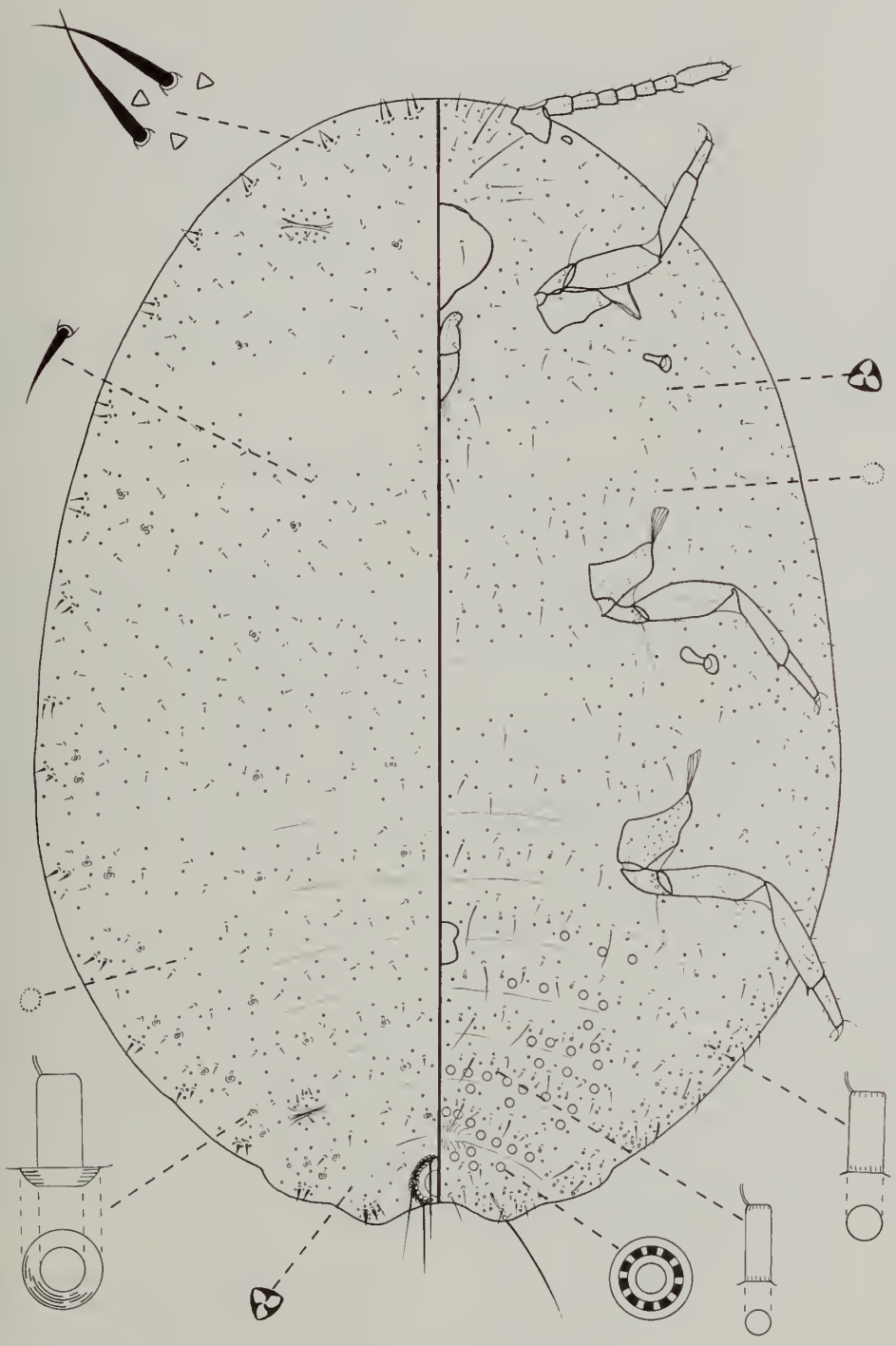

Fig. 39 *Planococcus vovae* (Nasonov).

ducts sometimes present on margins of thoracic segments. Simple pores minute, evenly but sparsely distributed.

Dorsum. Multilocular disc pores absent. Trilocular pores and simple pores as for venter. Tubular ducts, variable in size but larger than those on the venter and usually with rims, variable in number, most numerous at posterior end of body, scattered over dorsum, a total of 13–110 ducts present over entire dorsum. Setae moderately long and fine, longest seta on abdominal segments VI or VII about 20–35 μm long.

MATERIAL EXAMINED

89 ♀ (including type material listed below and original material of *Pseudococcus inamabilis*) (BMNH, MNNH, USNM, VCI, ZIL).

Pseudococcus vovae Nasonov. Lectotype ♀, **U.S.S.R.:** Varsoviensi Province, on *Juniperus communis*, 24.vii.1906 (ZIL).

DISTRIBUTION. Palaearctic Region: Cyprus, England, Germany, Greece, Hungary, Iran, Israel, Italy, Morocco, Poland, Turkey, U.S.S.R. Neotropical Region: Brazil.

HOSTPLANTS. Cupressaceae: *Cupressus glauca, C. gloveniana, C. macrocarpa, C. sempervirens, C. virginiana, Juniperus communis, Thuja occidentalis*.

REMARKS. *P. vovae* is similar to *P. taigae*, but differs in having fewer ducts on the dorsum, in lacking ventral tubular ducts on the head, in having more distinct ostioles, and by having more flagellate dorsal and cerarian setae. Both of these species occur only on Cupressaceae, as does the similar *Crisicoccus matesovae* (Fig. 37).

P. vovae has variable numbers of dorsal tubular ducts, as discussed by Cox & Ben-Dov (1986). In specimens from the Mediterranean Basin, these ducts occur in low numbers and may be confined to the posterior abdominal segments. In those from central Europe, however, these ducts are much more numerous and occur over the entire dorsum. The latter specimens resemble *P. taigae*, from the eastern Palaearctic Region, which has even more numerous dorsal ducts. Further work is needed, based on many more specimens from central Europe and the eastern Palaearctic Region, to determine whether there is a single, variable species, or a complex of species with different geographical distributions.

Ezzat & McConnell (1956) erected a new genus *Allococcus*, with *Pseudococcus inamabilis* as the type-species. *Allococcus* and *Planococcus* were distinguished by these authors by the nature of the dorsal tubular ducts, those of *Allococcus* having rims, and those of *Planococcus* not having rims. However, dorsal tubular ducts with the appearance of oral rims occur variably in some individuals of several species of *Planococcus*, including the type-species, *P. citri*. These ducts are not as large, or with such pronounced rims, as those found in other genera such as *Pseudococcus*. Following the synonymy of *Pseudococcus inamabilis* with *Pseudococcus vovae* and the placement of this species in *Planococcus*, *Allococcus* became a synonym of *Planococcus*. Most of the species contained in *Allococcus* at that time were transferred to a new genus, *Delottococcus*, by Cox & Ben-Dov (1986).

ECONOMIC STATUS. This species often reaches high numbers on *Cupressus* used as shelter trees in orchards, but is usually heavily parasitized.

Planococcus zairensis sp. n.

(Fig. 40)

ADULT FEMALE. Mounted specimens broadly oval to rotund, length 1.2–1.7 mm, width 0.7–0.9 mm. Margin of body with a complete series of 18 pairs of cerarii, each with 2, somewhat elongate, conical setae. Legs elongate; hind trochanter + femur 170–195 μm long, hind tibia + tarsus 295–220 μm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur 1.12–1.14; translucent pores present on hind coxae and tibiae. Inner edges of ostioles moderately sclerotized. Circulus small and quadrate, width 40–55 μm. Cisanal setae shorter than anal lobe setae. Anal lobe cerarii each situated on a small, moderately sclerotized area.

Venter. Multilocular disc pores sparsely present around vulva, 1–3 pores present on posterior edges of median areas of abdominal segment VI, and 1 pore sometimes present on each margin of segments VI or VII. Trilocular pores sparsely but evenly distributed. Oral collar tubular ducts of 1 size only, confined to abdomen, present in small numbers on median areas of abdominal segments V-VII and single ducts sometimes present on margins of segments VI or VII. Simple pores about half the size of the trilocular pores, scattered over entire venter.

Dorsum. Multilocular disc pores and tubular ducts absent. Trilocular pores moderately numerous and evenly distributed. Simple pores about twice the size of the trilocular pores, present in small groups on midline of head, thorax and anterior abdominal segments. Setae short and stout, longest seta of abdominal segments VI or VII 12–15 μm long.

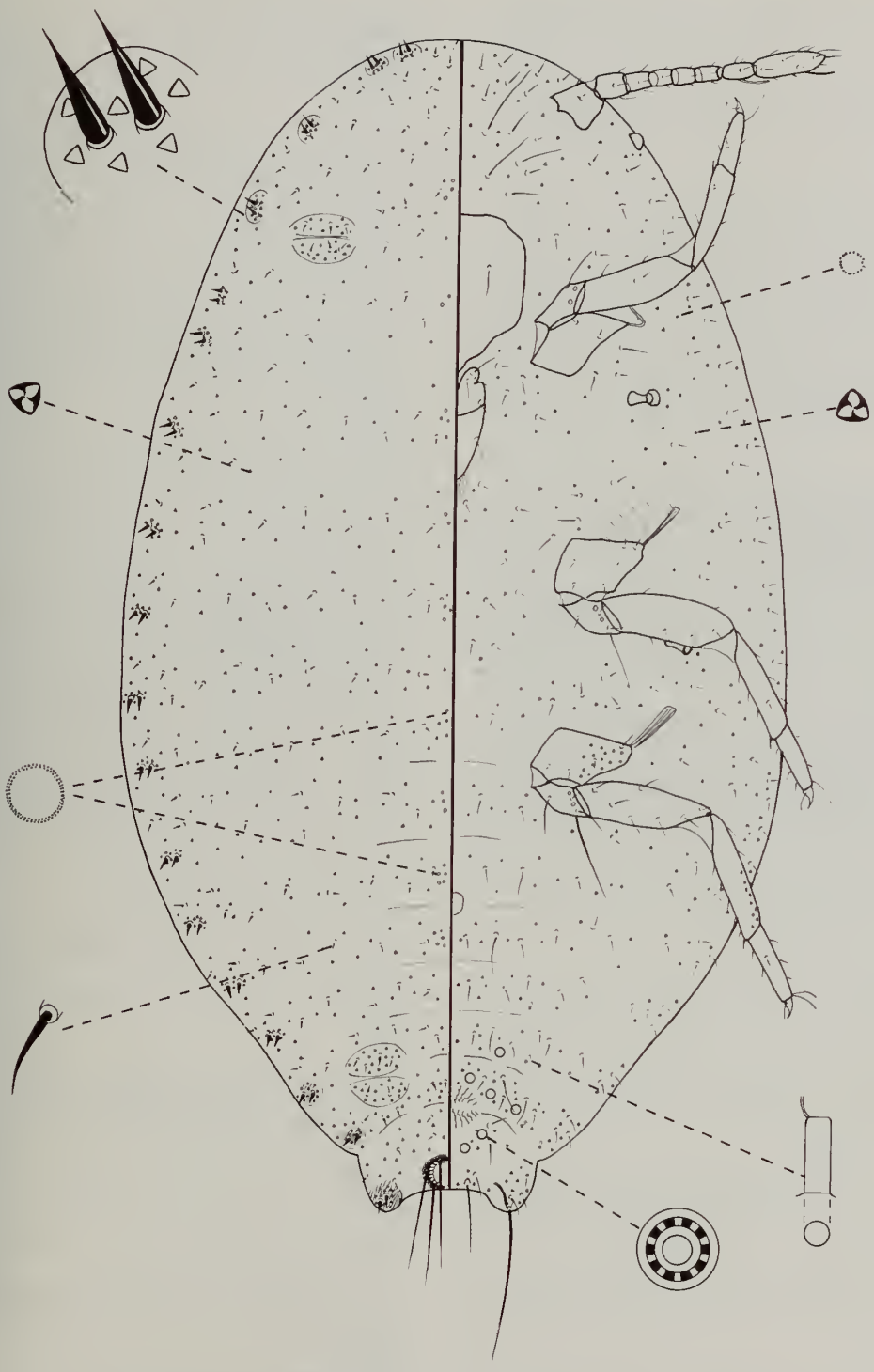

Fig. 40 *Planococcus zairensis* sp. n.

MATERIAL EXAMINED

Holotype ♀, **Zaire** (Belgian Congo): Elisabethville [Lubumbashi], 1919 (*Ringeot*) (MNHH).

Paratypes. 7 ♀ (1 on same slide as holotype), same data as holotype (BMNH, MNNH).

DISTRIBUTION. Afrotropical Region: Zaire.

HOSTPLANTS. Unknown.

REMARKS. *P. zairensis* is similar to the orchid-feeding *dendrobii*-group comprising *P. dendrobii, P. hosyni, P. orchidi* and *P. philippinensis* in its size, body shape, and distribution of multilocular disc pores and tubular ducts. It differs from these species in lacking knobbed dorsal setae. It is also similar to *P. boafoensis*, but lacks the distinctly protruding cerarii of this species.

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Invalid names are in *italics*; principal references are in **bold.**